

SUPPLEMENTARY DATA

Retinoic Acid Mediates Visceral-specific Adipogenic Defects of Human Adipose-derived Stem Cells

Kosuke Takeda, Sandhya Sriram, Xin Hui Derryn Chan, Wee Kiat Ong, Chia Rou Yeo, Betty Tan, Seung-Ah Lee, Kien Voon Kong, Shawn Hoon, Hongfeng Jiang, Jason J. Yuen, Jayakumar Perumal, Madhur Agrawal, Candida Vaz, Jimmy So, Asim Shabbir, William S. Blaner, Malini Olivo, Weiping Han, Vivek Tanavde, Sue-Anne Toh, and Shigeki Sugii

Supplementary Experimental Procedures

RNA-Seq experiment and analysis

Total RNA was extracted from SC and VS fat depots using Qiagen RNeasy plus kit. Poly-A mRNA was then enriched from ~5 µg of total RNA with oligo dT beads (Life Technologies). Approximately 100 ng of poly-A mRNA recovered was used to construct multiplexed strand-specific RNA-seq libraries as per manufacturer's instruction (NEXTflex™ Rapid Directional RNA-SEQ Kit (dUTP-Based) v2). Individual library quality was assessed with an Agilent 2100 Bioanalyzer and quantified with a QuBit 2.0 fluorometer before pooling for sequencing on Illumina HiSeq 2000 (1x101 bp read). The pooled libraries were quantified using the KAPA quantification kit (KAPA Biosystems) prior to cluster formation. Fastq formatted reads were processed with Trimmomatic to remove adapter sequences and trim low quality bases (LEADING:3 TRAILING:3 SLIDINGWINDOW:4:15 MINLEN:36). Reads were aligned to the human genome (hg19) using Tophat version 2 (settings --no-coverage-search --library-type=fr-firststrand). Feature read counts were generated using htseq-count (Python package HTSeq default union-counting mode, strand=reverse). Differential Expression analysis was performed using the edgeR package in both 'classic' and generalized linear model (glm) modes to contrast SC and VS adipose tissues from 8 non-diabetic patients. iPathwayGuide (Advaita bioinformatics), which is a web-based pathway analysis tool, was further employed to identify the top biological pathways regulated. A false discovery rate cutoff of 0.05 and fold change of at least 2.0 was used to call significance.

Microarray experiment and analysis

RNA from ASCs was isolated using the TRIzol reagent (Invitrogen) and purified with the Column RNA easy kit (Qiagen) according to the manufacturer's instruction. Double-stranded cDNA was synthesized from 500 ng of isolated mRNA with an oligo (dT) primer by using SuperScript Choice (Invitrogen) containing a T7 RNA polymerase promoter site, and then purified with Phase Lock Gel (Eppendorf). Biotin-labeled cRNA was prepared by transcribing with an X transcript labeling kit (Enzo). After adjusting for possible carryover of residual RNA, a mixture containing 15 µg of biotinylated cRNA was prepared and hybridized to the Illumina Human HT-12 v4 array that has 47,000 probe sets representing more than 31,000 different annotated genes. After 16 hours of hybridization, the Beadchips were washed, Cy3-labeled, and scanned on Illumina BeadArray reader. The data files were uploaded to GenomeStudio (Illumina) for background subtraction and analyzed on Partek Genomic Suite. The data was normalized using quantile normalization and an Analysis of Variance (ANOVA) was performed. A list of differentially expressed genes was created using a fold-change cut-off larger than 2.0 and a False Discovery Rate (FDR) cut-off less than 0.05. The data will be deposited in NCBI database.

SUPPLEMENTARY DATA

LC/MS analyses of retinoids

Samples were extracted using 100 µl out of 400 µl cell solution (2.5×10^5 ASCs) diluted in PBS. 500 µl of absolute ethanol containing 100 ng of retinyl acetate (Sigma-Aldrich) was then added as an internal standard. Subsequently, 4 ml of hexane was mixed with the samples and centrifuged for 10 min at 2000 g. The organic upper phase was then isolated and evaporated with N₂. The dried lipid was resuspended in 30 µl of methanol:acetonitrile (vol/vol, 1:1) and transferred to an autosampler vial (Waters Corp.) for analysis.

For aTRA extraction, 0.5 ml of 0.025 M KOH in ethanol was added to 300 µl cell solution (1.5×10^6 ASCs). 5 ng of aTRA-d5 dissolved in absolute ethanol was added to each extraction as internal standard. The aqueous phase was extracted with 4 mL of hexane. The organic phase containing nonpolar retinoids (retinol and retinyl ester) was removed. 30 µl of 8 M HCl was added to the aqueous phase, and polar retinoids (aTRA) were removed by extraction with 4 mL hexane. Organic phases were removed under a gentle stream of N₂. RA extracts were resuspended in 40 µl of acetonitrile and transferred to amber LC/MS vials. All LC/MS analyses were performed using a Waters Xevo TQ MS Acquity UPLC system (Waters Corp.), under the control of MassLynx software V4.1. Prior to injection, samples were maintained in the autosampler at 4°C. Samples were injected into an Acquity UPLC BEH Phenyl column (3.0 × 100 mm; with 1.7 µm particles) for retinol and an ACQUITY UPLC BEH HSS column (3.0 X 100 mm; 1.7 µm particle size) for analysis of aTRA. Samples were separated in the presence of formic acid using water/acetonitrile gradients for aTRA. Positive ESI-MS was performed in the multiple reaction monitoring (MRM) mode. Penta-deuterated aTRA (aTRA-d5) was employed as an internal standard.

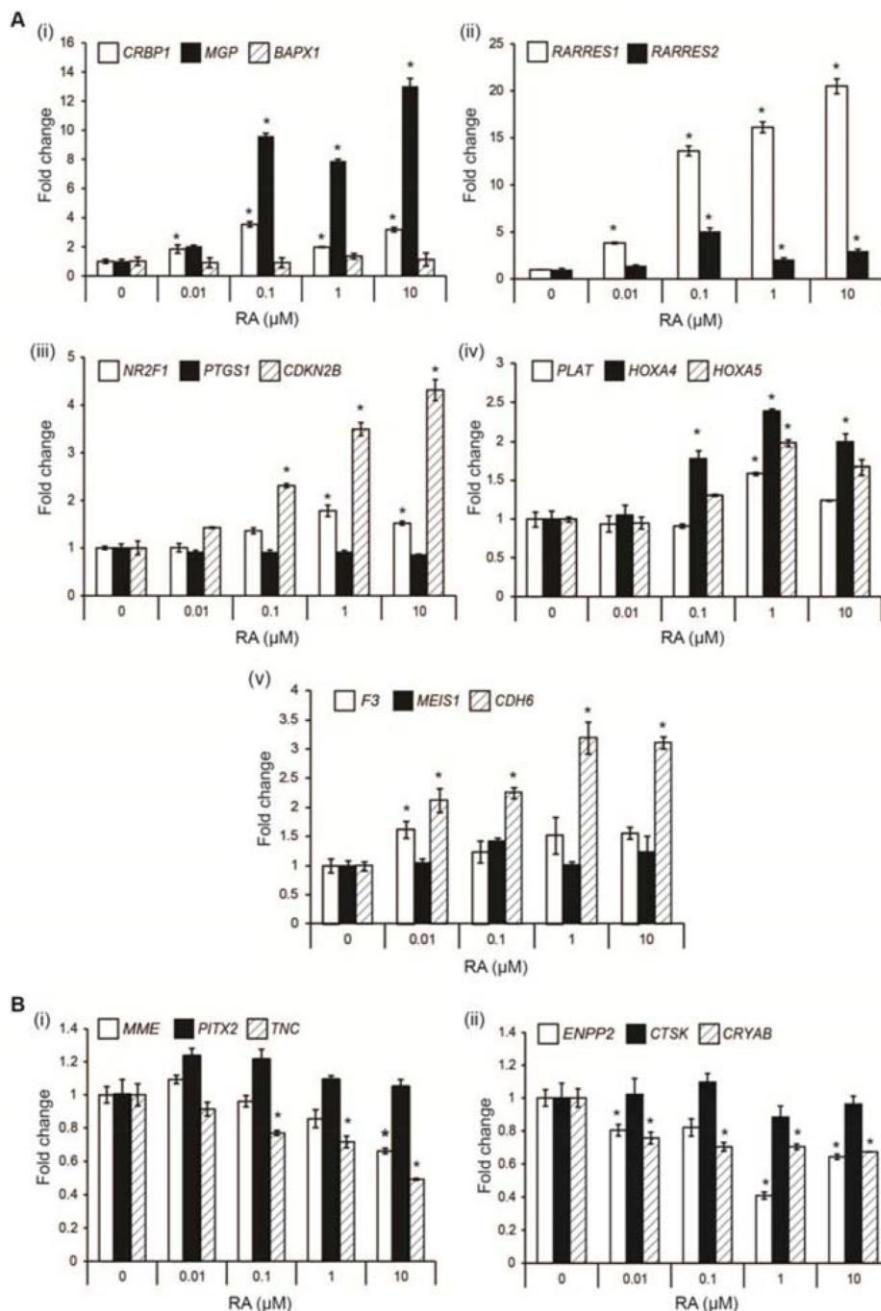
Measurement of endogenous RA levels by Surface-enhanced Raman spectroscopy (SERS)

ASC pellet samples were sonicated for 30 min, and centrifuged. 2 µl of the supernatant was diluted with 48 µl of sample diluents (Biosource). 50µl of the diluted samples were placed into the micro-well followed by 50µl of HRP conjugate, which had been pre-coated with anti-retinoic acid (Biosource). Samples were mixed well with the plate shaken gently for 60 seconds and incubated for 60 minutes at 37°C. They were then washed five times with 200µl Wash Buffer (Biosource), and let stand for 2 minutes. After any remaining liquid was decanted, 90µl of TMB (3,3',5,5'-Tetramethylbenzidine) Substrate (Sigma-Aldrich) was added to each well and incubated for 20 minutes at 37°C, protected from light. 50µl of 0.5 M H₂SO₄ was then added to each well to stop the reaction. Before taking SERS measurement, 45 µL of 60 nm Au colloid (BBI Solutions) is added to the reaction mixture. 10 µL of the solution mixture was dropped onto the glass slide and protected with coverslip. SERS measurements were performed in reflection mode with a Raman microscope (Renishaw InVia) using a 633 nm excitation laser with 5% laser power, a 1800 line/mm grating and a cooled CCD (-70°C). A 20X objective lens (NA 0.4) delivered the laser beam and collected the back scattered light. Rayleigh scattering was blocked with a notch filter. The laser spot size was ~3 µm with a power of 0.28mW. Measurements were performed with a 10 second integration time and at multiple positions across each SERS region with data averaged. Background corrections and curve fittings were carried out using WiRE 3.2 (Renishaw software). Spectra were background subtracted by a 6-order polynomial fit before the curve-fitting procedure. The instrument is calibrated with signal from a silicon standard at 520 cm⁻¹. Different aTRA concentrations were calculated from standard RA curve based on the intensity of 1605 cm⁻¹ peak from TMB²⁺ generated from TMB (Figure S2).

SUPPLEMENTARY DATA

Supplementary Figure S1. RA induces majority of VS-ASC genes and suppresses a subset of SC-ASC genes

SC-ASCs were treated with varying concentrations of RA, ranging from 0.01 μ M to 10 μ M RA for 48 hours and RT-qPCR was performed on the RNA collected. (A) Representative graphs showing significant increase in mRNA expression of VS-ASC enriched genes from Figures 2 and 3, including *CRBP1* (i), *MGP* (i), *RARRES1* (ii), *RARRES2* (ii), *NR2F1* (iii), *CDKN2B* (iii), *PLAT* (iv), *HOXA4* (iv), *HOXA5* (iv), *F3* (v) and *CDH6* (v) and no change in *BAPX1* (i), *PTGS1* (iii) and *MEIS1* (v) expression in SC-ASCs from S11, upon RA treatment. (B) Representative graphs showing significantly decreased mRNA expression of SC-ASC enriched genes from Figure 3, such as *MME* (i), *TNC* (i), *ENPP2* (ii) and *CRYAB* (ii), and no change in *PITX2* (i) and *CTSK* (ii) expression in SC-ASCs from S11 upon RA treatment ($n=2$). * $p<0.05$ denotes significance.

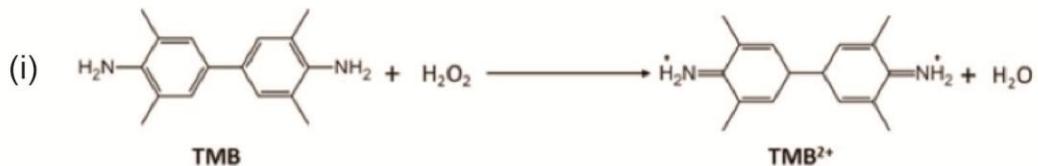


SUPPLEMENTARY DATA

Supplementary Figure S2. Ultrasensitive SERS measurement of RA

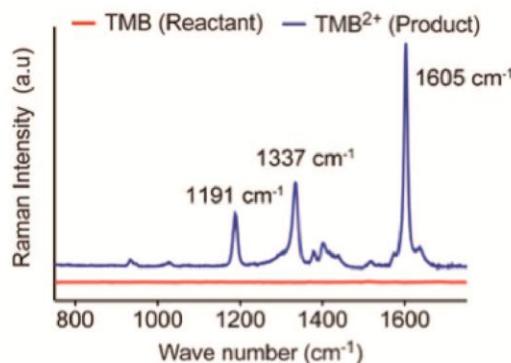
(A) The scheme of TMB to TMB^{2+} reaction (i) and SERS measurement using Au colloid (ii). (B) Comparison of the SERS spectra for both reactant TMB and product TMB^{2+} . (C) RA concentration dependent SERS spectra of TMB^{2+} . RA levels were calculated based on the intensity of 1605 cm^{-1} peak from TMB^{2+} . (D) Representative graph showing increased levels of RA in VS-ASCs compared to SC-ASCs as measured by SERS. The data shown are calculated from cells of five subjects (S2, S4, S6, S11 and S13). ** $p < 0.01$ denotes significant change ($n=5$). This figure is related to Figure 4A-B.

A

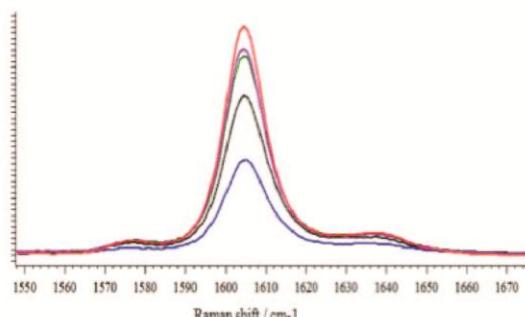


(ii) $\text{TMB}^{2+} + \text{Au colloid} \longrightarrow \text{SERS measurement}$

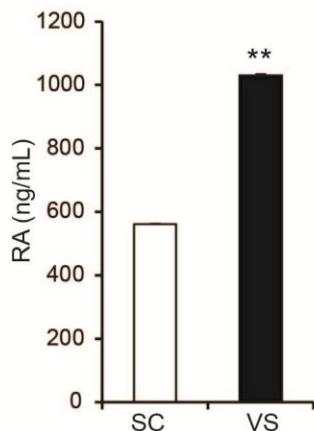
B



C



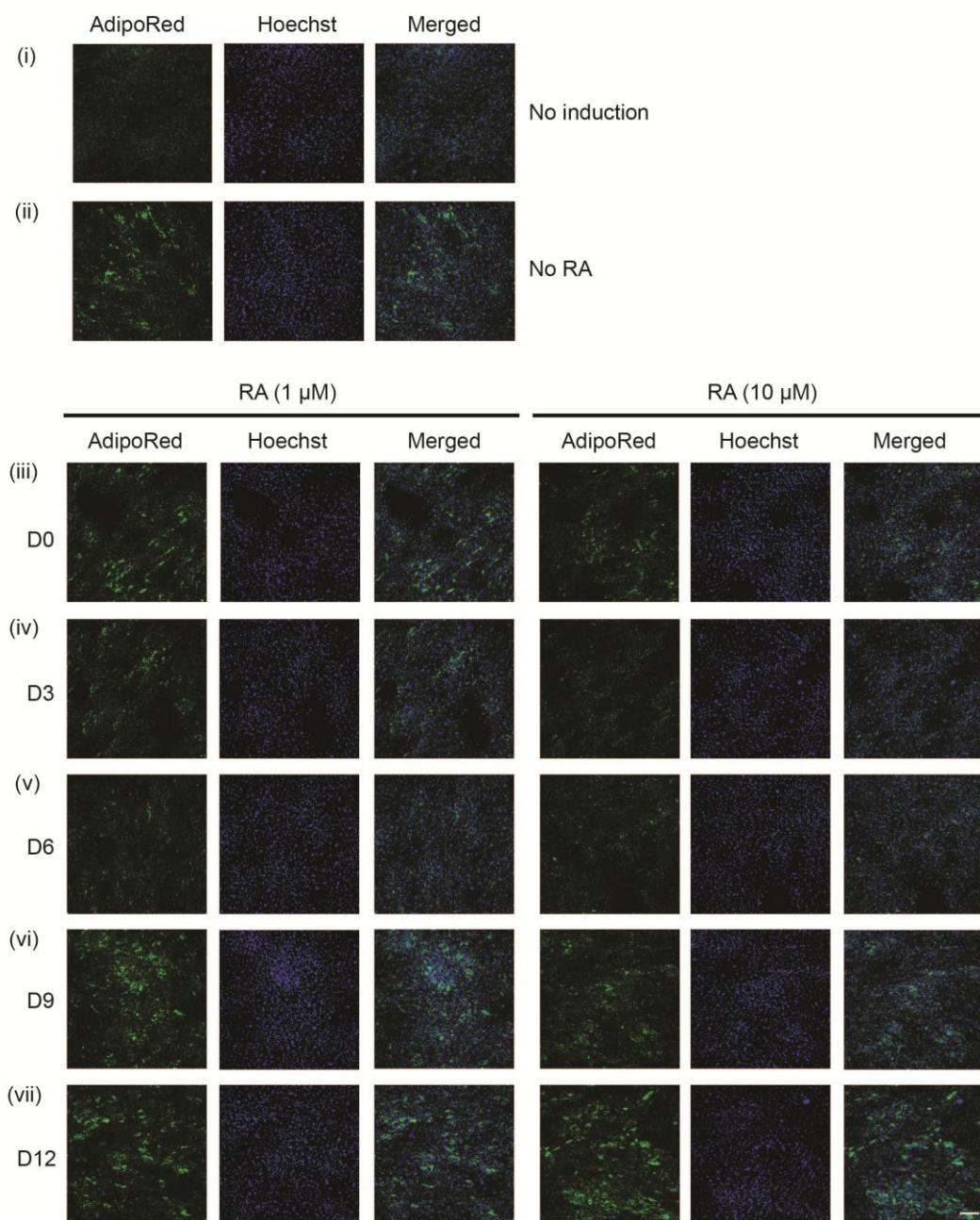
D



SUPPLEMENTARY DATA

Supplementary Figure S3. RA inhibits the early stage of adipocyte differentiation of VS-ASCs

Representative 10X images showing the lipid accumulation (AdipoRed-green) and the nuclei (Hoechst 33342-blue) in S11 VS-ASCs treated with 1 μ M or 10 μ M of RA at different time points as indicated. (i) No induction, (ii) No RA, (iii) D-2 to D0, (iv) D0 to D3, (v) D3 to D6, (vi) D6 to D9, or (vii) D9 to D12 treatment with RA. For the presentation purpose, the fluorescent intensities were enhanced to the same degree for all images. Scale bar represents 100 μ m (n=2). This figure is related to Figure 5.

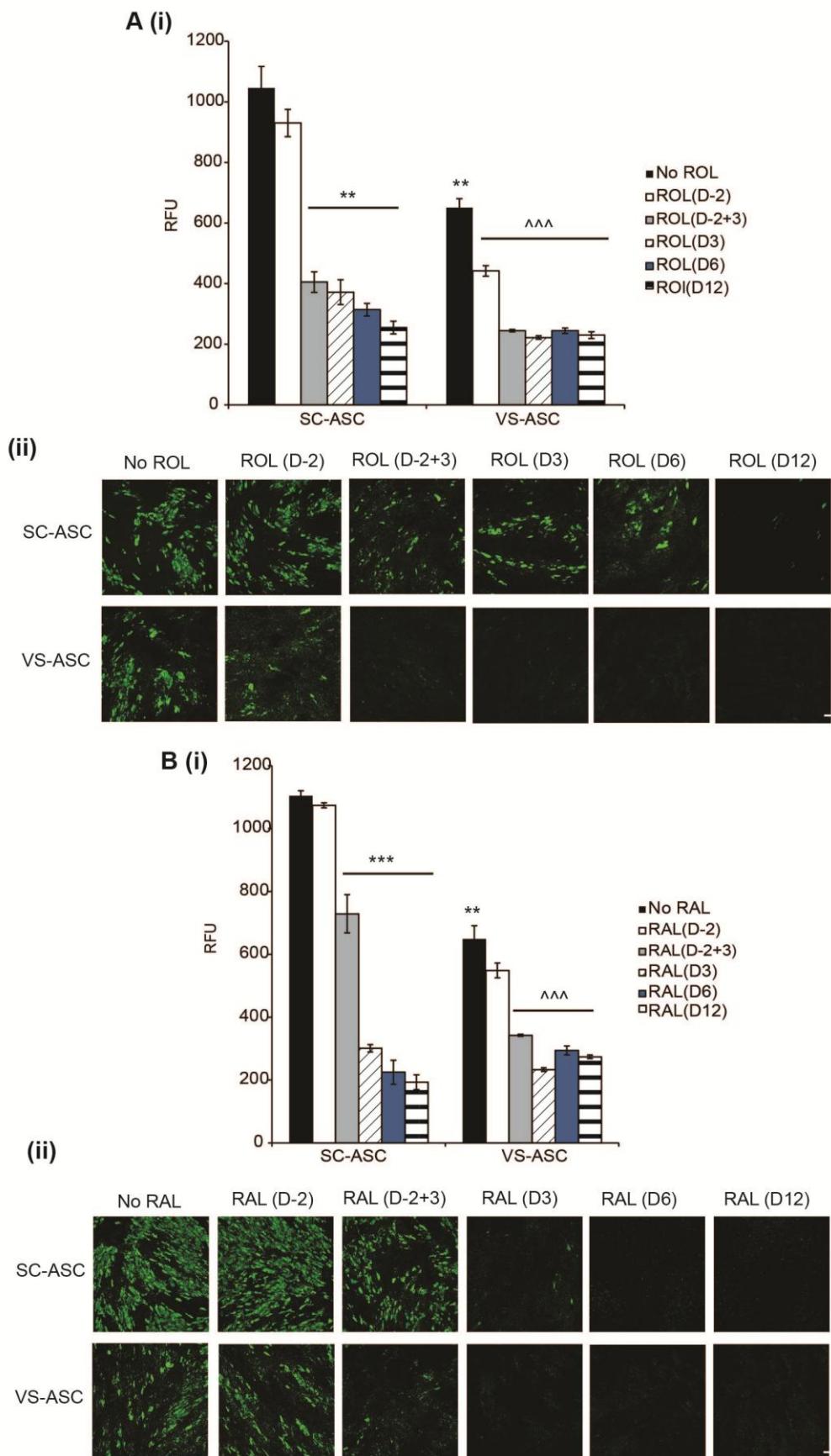


SUPPLEMENTARY DATA

Supplementary Figure S4. Retinol (ROL) and Retinaldehyde (RAL) inhibit adipocyte differentiation of ASCs

(A) (i) Representative graph showing relative fluorescence units (RFU) of AdipoRed staining on S11 SC- and VS-ASCs. ASCs were treated with 50 μ M of ROL at different time points as indicated. **p<0.01 denotes significant fold change against respective “No ROL” control SC-ASC samples and ^**p<0.001 denotes significant fold change against “No ROL” control VS-ASC samples in RFU corresponding to the quantitation of lipid accumulation during adipocyte differentiation (n=2). (A) (ii) Representative 10X images showing the lipid accumulation (AdipoRed-green) in S11 SC-ASCs and VS-ASCs treated with 50 μ M of ROL at different time points as indicated. Similar results were obtained from experiments using S12. For the presentation purpose, the fluorescent intensities were enhanced to the same degree for all original images. Scale bar represents 100 μ m (n=2). (B) (i) Representative graph showing relative fluorescence units (RFU) of AdipoRed staining on S11 SC- and VS-ASCs. ASCs were treated with 10 μ M of RAL at different time points as indicated. **p<0.01 and ***p<0.001 denotes significant fold change against respective “No RAL” control SC-ASC samples and ^***p<0.001 denotes significant fold change against “No RAL” control VS-ASC samples in RFU corresponding to the quantitation of lipid accumulation during adipocyte differentiation (n=2). (B) (ii) Representative 10X images showing the lipid accumulation (AdipoRed-green) in S11 SC-ASCs and VS-ASCs treated with 10 μ M of RAL at different time points as indicated. Similar results were obtained from experiments using S12. For the presentation purpose, the fluorescent intensities were enhanced to the same degree for all original images. Scale bar represents 100 μ m (n=2).

SUPPLEMENTARY DATA



SUPPLEMENTARY DATA

Supplementary Table S1. RNA-seq analysis of differentially expressed genes from VS and SC depots

Gene Symbol	logFC	Fold Change (VS Vs SC)	P Value
SCEL	9.787	883.143	7.00E-59
LRP2	9.457	702.890	5.94E-77
KLK7	9.418	684.051	1.51E-56
WT1	9.083	542.471	3.33E-40
KLK5	8.970	501.349	4.90E-57
C21orf62	8.962	498.540	8.31E-51
WT1-AS	8.772	437.266	2.81E-26
LRRN4	8.559	377.128	2.88E-49
CFTR	8.522	367.563	8.01E-34
SYT4	8.411	340.392	7.13E-51
ISL1	8.379	333.002	1.02E-39
SGPP2	8.315	318.418	1.95E-42
DNAJC22	8.270	308.650	1.30E-37
CDH3	8.167	287.374	3.23E-83
ANXA8	8.134	280.976	1.86E-22
LOC642366	8.109	276.183	5.60E-39
PKHD1L1	8.091	272.717	1.60E-28
MUC16	8.089	272.377	2.55E-52
DSC3	8.072	269.056	2.60E-45
TMEM151A	8.024	260.381	2.16E-49
ANXA8L1	7.924	242.811	3.85E-22
KLK11	7.865	233.155	3.08E-26
GATA5	7.858	231.989	1.51E-23
MSLN	7.762	217.007	1.73E-27
UPK1B	7.720	210.807	1.92E-40
KLK8	7.517	183.188	2.23E-22
KRT6A	7.510	182.219	2.01E-23
CGN	7.509	182.124	4.48E-25
ITLN1	7.472	177.536	9.82E-26
ALOX15	7.442	173.931	8.84E-35
GALNT9	7.425	171.804	4.98E-13
CBLN4	7.242	151.339	2.08E-14
ITLN2	7.215	148.611	1.37E-30
BARX1	7.159	142.936	6.13E-29
CKMT1B	7.157	142.719	9.62E-27
BNC1	7.093	136.519	8.80E-26
KIRREL2	6.946	123.333	1.02E-08
COX6B2	6.936	122.484	3.99E-16
LOC400940	6.881	117.905	7.54E-34
CLDN1	6.866	116.656	2.08E-18
FAM163A	6.836	114.228	2.13E-13
MYRF	6.805	111.841	3.48E-18
CKMT1A	6.766	108.815	2.79E-24
PSAPL1	6.659	101.023	3.64E-08
KRT19	6.658	100.980	3.89E-16
RBFOX1	6.564	94.641	2.89E-14
ILDR2	6.548	93.584	1.02E-19
KRT18	6.543	93.243	9.22E-19
KCNH5	6.543	93.230	1.14E-19
C1QL1	6.516	91.500	3.93E-30
CXCL6	6.499	90.442	2.94E-22
SIAH3	6.346	81.356	3.31E-12
CACNG4	6.343	81.174	3.46E-19
RIPK4	6.312	79.462	8.06E-16

WIF1	6.255	76.376	9.15E-09
MISP	6.255	76.347	9.79E-21
KRT80	6.219	74.513	3.45E-20
LRRTM1	6.214	74.250	6.16E-15
MGARP	6.185	72.767	1.40E-27
KRT8	6.165	71.744	1.86E-15
SLITRK5	6.154	71.231	1.84E-28
WNK4	6.117	69.416	4.87E-35
HS3ST6	6.065	66.929	4.43E-10
FAM101A	6.034	65.513	2.70E-12
EPS8L1	5.983	63.246	5.38E-22
GREM1	5.977	62.983	1.68E-19
TCF21	5.933	61.078	2.99E-100
CA9	5.928	60.870	3.36E-07
LRAT	5.923	60.653	1.42E-22
UPK3B	5.862	58.165	5.31E-16
IGSF9	5.855	57.888	3.86E-15
HSD17B2	5.783	55.051	2.40E-08
CSDC2	5.761	54.215	1.43E-26
SERPINE3	5.744	53.602	9.46E-18
DPYS	5.732	53.147	4.48E-27
TMPRSS3	5.714	52.474	4.61E-35
IGFL2	5.710	52.362	5.52E-16
ANGPTL7	5.699	51.946	1.21E-19
KLK10	5.625	49.361	5.72E-15
GRB7	5.571	47.535	7.02E-14
LINC01018	5.522	45.954	1.70E-27
CAMSAP3	5.517	45.777	5.65E-14
SLC26A9	5.473	44.418	4.44E-05
ASTN1	5.401	42.245	2.88E-15
RNF39	5.357	40.978	1.06E-07
LHX9	5.349	40.762	1.78E-14
HSD17B6	5.342	40.555	8.17E-10
C4B	5.316	39.827	1.01E-65
HOOK1	5.218	37.225	3.31E-18
FAM110C	5.198	36.712	1.49E-18
HNRNPA1P33	5.186	36.413	1.19E-18
NPHS1	5.179	36.216	3.22E-12
CRB2	5.177	36.187	4.89E-10
SEC14L6	5.168	35.950	2.49E-15
FLRT3	5.161	35.788	1.93E-17
TCEAL2	5.139	35.225	8.85E-12
RSPO1	5.135	35.127	4.76E-05
PTN	5.128	34.973	4.11E-63
TNNT1	5.121	34.795	2.33E-09
CARNS1	5.109	34.518	8.32E-14
SMPD3	5.089	34.033	1.09E-15
C10orf82	5.070	33.595	5.48E-12
TCEAL6	5.034	32.758	9.49E-15
SBK2	5.028	32.635	3.05E-09
EPPK1	5.018	32.403	4.85E-39
NELL1	4.987	31.713	3.08E-15
KCTD19	4.956	31.044	1.08E-14
FAM153B	4.907	29.994	1.06E-20
RPRM	4.878	29.407	1.61E-10
ISM2	4.869	29.223	5.73E-13
FAM160A1	4.822	28.278	4.11E-18
DPP10	4.813	28.103	1.78E-12

SUPPLEMENTARY DATA

CCDC64	4.794	27.736	1.43E-21
PRR15L	4.794	27.735	0.000489848
KCTD8	4.788	27.632	5.50E-21
TFF3	4.771	27.298	2.91E-10
CXADR	4.761	27.107	1.17E-09
CYP2J2	4.726	26.470	9.99E-19
IL20	4.724	26.436	1.94E-11
CST6	4.670	25.458	2.17E-17
IGFBP1	4.653	25.153	1.46E-17
CLUL1	4.638	24.904	2.53E-09
SLC27A2	4.627	24.703	3.76E-11
RAET1E	4.626	24.696	5.46E-11
SERTM1	4.625	24.670	1.16E-07
IL24	4.620	24.595	0.000482489
CLEC4M	4.617	24.531	3.69E-06
KNDC1	4.614	24.490	1.10E-12
WFDC2	4.560	23.586	2.08E-08
THSD4	4.540	23.260	3.57E-20
ESRP2	4.517	22.902	1.35E-15
ANXA9	4.517	22.897	2.73E-12
MTMR7	4.489	22.458	1.74E-20
SLC28A3	4.486	22.415	1.55E-10
MMP24	4.439	21.692	4.47E-09
PCSK9	4.356	20.479	8.71E-08
VSNL1	4.350	20.393	1.13E-13
MSI1	4.345	20.321	2.16E-13
BCHE	4.339	20.243	1.50E-22
FAM153C	4.331	20.126	6.47E-23
CNTNAP2	4.327	20.077	6.39E-19
CACNB2	4.319	19.960	7.10E-11
DMKN	4.301	19.713	1.57E-24
VIPR2	4.301	19.712	2.91E-36
LINC00842	4.270	19.289	5.45E-29
C4A	4.243	18.935	1.40E-22
SCG5	4.240	18.901	1.20E-13
EEF1A2	4.235	18.828	6.03E-08
FGF9	4.209	18.490	5.50E-14
SBSPON	4.168	17.970	4.44E-11
SLC6A3	4.135	17.571	2.87E-11
B4GALNT4	4.131	17.527	4.96E-14
ARMC4	4.126	17.457	2.07E-06
FRAS1	4.111	17.283	3.17E-08
NTNG1	4.108	17.238	7.08E-18
CCL21	4.100	17.145	1.84E-10
ROR2	4.069	16.786	4.09E-16
STAB2	4.064	16.724	5.48E-12
UNC5B-AS1	4.056	16.629	7.30E-07
CHAC1	3.992	15.910	7.42E-09
ITGB8	3.987	15.855	1.37E-09
VAT1L	3.966	15.623	9.85E-07
NSG1	3.957	15.530	1.48E-10
UCP1	3.877	14.696	9.01E-08
LSAMP	3.865	14.567	1.26E-13
MAPK15	3.857	14.491	1.48E-15
CDH1	3.831	14.235	1.68E-05
ASPHD1	3.827	14.195	8.58E-10
TRIM17	3.808	14.006	1.10E-08
GRIK5	3.796	13.890	1.08E-13
LOC401134	3.782	13.752	2.02E-06
TGM1	3.778	13.716	7.15E-08

DPCR1	3.767	13.612	0.000839439
RORB	3.735	13.316	2.12E-13
FAM167A	3.729	13.257	1.29E-12
GPM6A	3.729	13.257	1.04E-19
ATRNL1	3.715	13.128	7.23E-08
SYN1	3.709	13.077	2.60E-12
LOC728084	3.683	12.847	3.78E-14
PEX5L	3.683	12.841	1.90E-16
PCP4	3.650	12.556	9.73E-05
SPEG	3.649	12.548	6.19E-10
LYPD6	3.646	12.516	2.87E-12
FMN2	3.637	12.440	2.58E-13
IQCA1	3.630	12.384	2.76E-08
POF1B	3.624	12.332	3.97E-07
FAXC	3.624	12.326	1.54E-05
REEP1	3.622	12.310	8.35E-11
NKX3-2	3.592	12.061	7.75E-17
NGEF	3.583	11.987	3.29E-07
SMTNL2	3.570	11.878	1.40E-06
DKFZp434J0226	3.570	11.875	1.67E-06
ERBB3	3.564	11.829	7.12E-17
TFPI2	3.546	11.681	3.00E-23
NR2F1	3.538	11.618	1.06E-33
WNT10A	3.532	11.569	1.59E-20
BEX2	3.526	11.517	4.93E-09
BMP3	3.504	11.343	4.13E-05
CHGB	3.484	11.190	2.57E-07
PCDHA12	3.480	11.156	4.10E-09
LINC00473	3.467	11.056	1.57E-05
DLGAP2	3.466	11.052	4.54E-16
IL1A	3.430	10.775	0.00071
NPNT	3.424	10.730	2.47E-16
DOC2A	3.422	10.718	7.77E-16
RARRES1	3.401	10.566	2.07E-23
FBXO2	3.398	10.542	1.85E-11
GPR63	3.396	10.529	3.23E-09
TMEM255A	3.396	10.524	1.55E-12
PCDH20	3.395	10.522	1.02E-08
RHPN2	3.394	10.511	1.35E-11
WISP1	3.392	10.500	1.27E-05
DSP	3.343	10.149	2.02E-09
HPR	3.311	9.926	3.98E-10
PLEKHG4B	3.296	9.822	8.97E-09
SMPDL3B	3.290	9.778	8.00E-05
NRG4	3.281	9.717	2.05E-07
FAM153A	3.269	9.640	3.14E-11
CYP21A1P	3.268	9.632	1.32E-08
GJB2	3.254	9.538	4.06E-11
CBLN2	3.253	9.532	3.41E-06
GAL3ST2	3.252	9.528	0.000262907
CPA4	3.227	9.361	3.88E-05
WNT5A	3.227	9.361	2.15E-19
DAW1	3.218	9.306	6.33E-06
LOC101929494	3.192	9.141	6.77E-10
NGF	3.176	9.035	4.52E-10
FAM189A1	3.171	9.005	5.53E-11
HS6ST2	3.166	8.977	6.60E-05
ST6GAL2	3.164	8.964	1.02E-06
SLPI	3.134	8.778	9.26E-10
TRPM3	3.111	8.642	3.01E-07

SUPPLEMENTARY DATA

CACNA1G	3.110	8.637	1.08E-13
TNFSF14	3.097	8.558	2.14E-13
ZDHHC8P1	3.096	8.553	1.57E-06
RAET1G	3.090	8.514	1.47E-07
SULF1	3.069	8.390	1.07E-11
LOC284023	3.061	8.348	3.69E-12
NPAS1	3.055	8.309	6.25E-10
PARD6B	3.047	8.262	1.28E-07
RGS4	3.037	8.208	2.10E-06
ART4	3.033	8.185	1.03E-08
LRRN2	3.013	8.072	5.25E-19
FBXL16	2.991	7.952	1.42E-06
RASEF	2.977	7.875	8.75E-05
CLIC3	2.973	7.854	2.99E-13
NTRK1	2.956	7.759	2.22E-09
C7	2.949	7.719	1.62E-26
MMRN1	2.944	7.694	1.14E-06
HHIP	2.927	7.608	2.57E-06
KCNA4	2.919	7.565	2.90E-15
KIAA1211	2.911	7.523	8.87E-06
NELL2	2.909	7.511	8.24E-11
PRPH	2.899	7.457	9.96E-09
INMT	2.886	7.390	5.61E-16
BRINP2	2.878	7.353	7.03E-06
RIMBP2	2.847	7.197	5.81E-13
TRNP1	2.836	7.141	3.77E-10
GAL3ST1	2.799	6.961	8.78E-09
IGSF9B	2.794	6.935	3.14E-14
STK33	2.791	6.923	1.27E-07
LRRN1	2.790	6.918	2.18E-09
DPY19L2P2	2.783	6.884	2.57E-11
SCUBE1	2.779	6.866	8.35E-06
RAMP1	2.767	6.809	1.68E-08
CHST4	2.757	6.761	1.08E-07
ALDH1A2	2.757	6.758	2.63E-08
LINC01139	2.756	6.757	4.71E-05
MTUS2	2.739	6.676	8.03E-07
PLLP	2.728	6.625	3.92E-11
SHROOM3	2.722	6.596	1.23E-11
PRR15	2.720	6.591	8.30E-05
CYP21A2	2.711	6.547	3.59E-07
MYO5B	2.696	6.481	1.96E-05
MST1R	2.688	6.445	7.98E-12
SLC44A5	2.686	6.437	8.25E-09
EFNB3	2.683	6.421	1.45E-13
GADL1	2.681	6.411	0.000108449
PTPRZ1	2.678	6.398	0.00201704
NFASC	2.672	6.372	1.43E-28
MKX	2.672	6.371	9.83E-14
SSTR1	2.663	6.332	1.46E-05
PGM5P3-AS1	2.660	6.322	1.25E-09
GATA6	2.660	6.318	1.48E-15
AMN	2.653	6.288	1.79E-07
TVP23A	2.652	6.286	4.85E-11
COBL	2.641	6.240	4.81E-06
PDPN	2.638	6.226	2.75E-10
NWD2	2.633	6.205	1.22E-10
HOXB-AS3	2.613	6.116	4.40E-14
GPR126	2.598	6.055	4.45E-12
TMID4	2.571	5.944	0.000378521
CFB	2.539	5.814	2.10E-05
DNER	2.536	5.800	4.72E-07
PAPPA	2.535	5.797	3.41E-13
SIX2	2.528	5.766	1.85E-11
KRT7	2.518	5.727	0.000180753
GATA6-AS1	2.516	5.719	3.82E-11
OSR1	2.512	5.705	5.79E-12
MAP3K9	2.509	5.694	1.29E-11
ASPG	2.509	5.692	7.49E-06
SCN3A	2.490	5.618	1.52E-10
KCNN3	2.483	5.590	7.44E-07
ALDH1L1-AS2	2.476	5.564	9.43E-13
TUBB4A	2.471	5.546	4.73E-08
SAMD11	2.464	5.518	1.57E-11
BCAS1	2.451	5.467	0.006054947
BDKRB1	2.446	5.450	0.00021565
SEZ6L2	2.438	5.419	2.13E-08
BEGAIN	2.433	5.402	3.82E-08
SDR42E1	2.430	5.389	2.11E-09
AADACL2	2.427	5.376	0.000110298
ADAMTSL3	2.422	5.358	2.08E-23
MCTP2	2.421	5.354	1.82E-06
BMPR1B	2.403	5.288	1.23E-06
KBTBD12	2.400	5.279	3.41E-05
KCNK1	2.400	5.279	2.21E-09
OBSCN	2.400	5.276	2.32E-12
SPTBN2	2.390	5.243	1.78E-12
PCSK1N	2.390	5.241	3.15E-08
RASSF6	2.386	5.228	0.001818367
RAB17	2.378	5.198	0.000251538
TSPAN5	2.367	5.160	2.79E-12
LIF	2.363	5.145	8.61E-05
DCT	2.355	5.116	2.51E-08
LAMP5	2.354	5.111	0.000137164
AMHR2	2.351	5.101	0.000118049
KLK1	2.347	5.086	0.000293807
FOXF1	2.346	5.084	1.94E-12
PCSK6	2.342	5.071	9.08E-11
RSPO3	2.339	5.059	1.08E-16
LOC100132813	2.325	5.012	0.005018854
GALNT14	2.317	4.983	2.15E-09
CDH2	2.304	4.937	6.08E-08
CLIC5	2.297	4.913	5.03E-13
HS3ST1	2.294	4.904	1.32E-06
GNG4	2.285	4.872	2.06E-05
ARNT2	2.283	4.866	4.88E-07
TNFAIP8L3	2.281	4.860	1.13E-06
C1orf145	2.281	4.860	3.91E-06
CTXN1	2.279	4.854	5.82E-05
APLPL1	2.271	4.825	6.59E-10
CDCP1	2.268	4.816	7.52E-05
PTPRQ	2.256	4.776	1.93E-18
VWA7	2.248	4.749	1.10E-07
AP1M2	2.243	4.735	0.000280002
BCO2	2.242	4.730	8.90E-09
PPAPDC1A	2.233	4.700	0.002146781
FERMT1	2.232	4.698	3.60E-05
SLAIN1	2.221	4.662	1.26E-11
GOLGA2P7	2.212	4.633	2.96E-09
TNNT2	2.211	4.631	8.77E-05

SUPPLEMENTARY DATA

LOC102724384	2.211	4.630	2.12E-08
FAM155A	2.201	4.597	1.77E-09
EZR	2.199	4.590	1.28E-07
LY6H	2.192	4.570	0.002246546
OGN	2.185	4.547	3.89E-08
TNK1	2.179	4.530	9.58E-07
CGNL1	2.172	4.505	2.87E-09
STK26	2.163	4.477	2.85E-06
SUSD5	2.157	4.459	3.11E-06
ARSJ	2.151	4.441	6.15E-08
ARHGAP44	2.124	4.358	3.00E-12
HAND2	2.122	4.353	5.14E-07
RBM11	2.121	4.350	0.000388693
SLC4A4	2.108	4.312	2.03E-17
SHISA3	2.105	4.302	2.10E-06
WWC1	2.099	4.285	2.58E-06
MKRN9P	2.094	4.269	0.004137459
WNT2B	2.088	4.252	4.15E-11
SLC39A8	2.084	4.240	1.46E-05
CLDN15	2.076	4.218	1.63E-09
SCN7A	2.074	4.211	1.37E-08
PRIMA1	2.073	4.208	4.58E-16
COLGALT2	2.072	4.206	2.44E-06
SLC2A12	2.069	4.195	2.69E-12
PLEK2	2.068	4.194	0.00079129
LOC101927157	2.049	4.139	0.000404032
CHODL	2.042	4.117	1.97E-05
CXCR6	2.039	4.110	2.05E-09
MFSD2A	2.036	4.100	0.000154871
FGFR3	2.026	4.072	6.58E-08
SYT17	2.025	4.071	2.33E-05
RASSF7	2.025	4.071	8.16E-09
GDF6	2.025	4.069	1.03E-06
ALDH1A3	2.022	4.060	4.02E-07
NEK5	2.015	4.042	0.000610228
CCDC3	2.010	4.027	4.18E-08
SGOL2	2.008	4.022	5.25E-07
GPR133	2.007	4.019	1.26E-06
BCAS4	2.000	4.001	0.001387234
PDZK1IP1	2.000	4.000	2.27E-07
PNMA2	1.998	3.995	1.46E-09
NUDT10	1.998	3.994	1.02E-06
CA11	1.990	3.973	4.20E-08
PROX1	1.989	3.970	4.69E-13
NEBL	1.989	3.969	4.91E-07
SRSF12	1.987	3.964	4.21E-06
PRKCZ	1.972	3.923	1.95E-07
CFI	1.970	3.917	2.65E-12
PRSS16	1.970	3.917	1.48E-05
COL9A3	1.966	3.908	5.39E-06
WDR86-AS1	1.965	3.905	4.00E-08
HAND2-AS1	1.961	3.893	8.84E-10
GLS2	1.954	3.875	1.82E-05
BEAN1	1.951	3.867	2.18E-05
FOLH1	1.944	3.847	3.30E-08
BZRAP1	1.940	3.836	1.19E-12
RDH10	1.939	3.835	1.92E-08
GREM2	1.937	3.830	0.003558723
PTGS1	1.931	3.814	4.62E-10
SLC12A8	1.930	3.810	6.17E-07
SLC16A4	1.930	3.810	3.02E-14
RGS9	1.929	3.808	4.50E-07
EVPL	1.923	3.791	0.000238385
SEMA3B	1.918	3.779	1.35E-20
METTL24	1.918	3.779	6.78E-06
HHIP-AS1	1.917	3.775	9.65E-05
FAR2P2	1.916	3.775	1.20E-07
NKD2	1.910	3.759	0.000227433
IL2RA	1.908	3.752	2.76E-09
LOC100507661	1.906	3.747	1.52E-05
KIAA0895	1.905	3.745	1.71E-07
TFAP2C	1.901	3.735	2.23E-07
KCTD14	1.892	3.710	6.94E-07
TRIM46	1.890	3.707	0.002038499
KLF5	1.889	3.703	0.000578806
WDR86	1.887	3.699	2.66E-12
LAYN	1.875	3.669	1.77E-06
CABP1	1.875	3.668	0.000667581
KLHL4	1.874	3.666	0.002360015
PLEKHB1	1.872	3.660	2.27E-07
MUM1L1	1.861	3.632	6.59E-13
DIRAS3	1.858	3.625	4.73E-05
SLC14A1	1.857	3.623	9.78E-07
KLHL32	1.853	3.612	1.50E-05
CD200	1.844	3.590	2.64E-10
CACNA1H	1.843	3.588	9.03E-07
CRMP1	1.843	3.587	0.000323088
MET	1.831	3.558	5.13E-08
CMYA5	1.829	3.554	6.22E-09
FAIM2	1.828	3.550	1.97E-06
TTC9	1.824	3.540	1.62E-06
CFAP46	1.809	3.503	0.00045055
NRK	1.808	3.501	3.26E-15
NCR3LG1	1.807	3.500	6.30E-05
PTPRH	1.804	3.492	6.85E-06
SPATA41	1.803	3.488	2.05E-06
LOC100506834	1.793	3.466	1.44E-08
IL18	1.788	3.453	5.58E-05
HOXA4	1.786	3.448	5.38E-09
DIRAS1	1.782	3.439	0.001263325
DIAPH3	1.781	3.437	0.002257861
TIMP1	1.772	3.415	5.11E-06
EGFEM1P	1.767	3.403	7.14E-08
PPFIA4	1.764	3.396	0.000147497
RARB	1.761	3.390	8.08E-08
KCNK5	1.760	3.386	0.000154721
CPNE5	1.759	3.386	7.51E-07
HTR2A	1.756	3.377	0.002839671
B3GALT2	1.746	3.355	0.001788623
SLC38A1	1.746	3.355	2.99E-07
PRG4	1.744	3.350	0.007152265
HIGD1B	1.738	3.335	1.98E-06
PLEKHA6	1.737	3.334	3.46E-08
LAMB1	1.733	3.325	1.36E-13
LMO7	1.733	3.323	7.83E-05
COL4A5	1.733	3.323	7.36E-08
SDC4	1.727	3.310	5.07E-05
LXN	1.724	3.305	3.08E-08
WNT6	1.722	3.300	0.000169453
TMEM158	1.719	3.292	0.000341021

SUPPLEMENTARY DATA

DLG2	1.718	3.290	1.15E-09	SFRP2	1.562	2.952	0.00018169
SCN2A	1.717	3.288	3.36E-07	CFAP43	1.561	2.950	0.000805452
GPR64	1.714	3.282	8.18E-08	TMEM26	1.554	2.936	4.43E-06
LRRC4B	1.714	3.280	5.62E-08	MICAL2	1.549	2.925	5.29E-09
HIST1H2BD	1.711	3.273	4.53E-06	TMEM132B	1.541	2.911	1.01E-05
SUSD3	1.706	3.262	4.10E-05	PAMR1	1.534	2.895	0.000644874
KIAA1644	1.702	3.254	0.001975257	LRFN5	1.533	2.894	3.06E-08
SEMA4G	1.701	3.251	5.04E-11	SOX6	1.531	2.890	3.91E-13
KIAA1244	1.700	3.249	3.65E-07	TNFRSF8	1.527	2.883	9.87E-06
CLDN11	1.697	3.242	0.000194069	JPH4	1.524	2.876	0.000117965
SMOC2	1.692	3.232	9.81E-10	GLIS3	1.521	2.870	3.39E-08
IDO1	1.689	3.223	9.12E-06	KIAA1804	1.519	2.866	0.001252706
PLAT	1.688	3.221	3.50E-10	SAMD12	1.518	2.864	1.20E-05
DSCAML1	1.685	3.215	6.86E-06	DLGAP1	1.511	2.850	0.000152152
GFPT2	1.682	3.208	0.000158039	DNAAF1	1.505	2.838	0.005303159
COL21A1	1.677	3.197	0.000167532	RELN	1.504	2.836	0.003020749
ABHD12B	1.676	3.196	0.000129712	SSX2IP	1.503	2.835	7.86E-05
SLC16A9	1.676	3.196	2.53E-06	MT1G	1.501	2.830	0.004720659
SNX22	1.675	3.192	1.19E-05	TMEM25	1.493	2.814	1.52E-16
PKP2	1.669	3.181	0.004236079	PTGDS	1.491	2.812	6.63E-07
FHDC1	1.664	3.168	1.97E-07	IL20RA	1.490	2.810	1.10E-06
LONRF2	1.663	3.166	3.93E-14	PCDHAC2	1.490	2.808	0.001550681
HOXA-AS2	1.660	3.161	1.33E-10	RXRG	1.486	2.801	9.24E-05
FLNC	1.659	3.159	0.00057304	SYCE1	1.484	2.798	0.005771162
GRIP2	1.649	3.135	4.26E-07	NLRP2	1.482	2.793	0.000800319
ESYT3	1.647	3.132	0.000275621	SLCO2A1	1.480	2.789	9.19E-09
PTHLH	1.643	3.124	0.000878909	GRIA1	1.478	2.785	9.40E-05
ACSM3	1.642	3.121	2.66E-07	ZC3H12B	1.475	2.780	8.90E-08
PROCR	1.636	3.108	2.87E-05	FAM46B	1.468	2.766	0.004019664
MST1	1.635	3.105	3.16E-07	PTK7	1.466	2.763	3.74E-08
RIMS4	1.634	3.103	0.000573899	MARVELD2	1.462	2.756	0.001300174
PTGIS	1.631	3.096	4.06E-05	SLC7A10	1.462	2.755	9.97E-07
RORC	1.623	3.081	0.00011237	IL1RL2	1.460	2.752	0.001013771
NAP1L2	1.620	3.073	1.47E-07	GFI1	1.454	2.740	6.01E-05
VSIG2	1.613	3.058	0.000207845	ALDH1L1	1.454	2.739	1.65E-07
RALGPS2	1.612	3.056	1.29E-09	PCDHGA12	1.452	2.736	1.50E-06
SEMA5A	1.606	3.043	1.47E-05	PM20D2	1.451	2.735	9.88E-11
AGT	1.605	3.042	3.92E-05	SPOCK2	1.442	2.718	1.13E-06
LOC100506718	1.604	3.040	2.68E-07	SLC1A2	1.442	2.717	0.000388531
MAMSTR	1.601	3.034	9.45E-07	CDC42BPG	1.441	2.715	0.000537476
IGFBP2	1.601	3.033	3.36E-12	CD244	1.437	2.707	0.000404995
MT1L	1.598	3.028	1.68E-11	CCBE1	1.427	2.690	6.26E-05
COL4A6	1.596	3.022	0.002474106	RIC3	1.421	2.677	1.53E-07
MROH7	1.594	3.019	1.20E-05	ZBTB7C	1.420	2.676	2.70E-06
POU6F2	1.594	3.019	0.000391026	BAII	1.416	2.669	1.19E-06
GLB1L2	1.593	3.018	1.91E-05	CPT1C	1.412	2.662	3.55E-08
MEIS1	1.592	3.014	2.52E-09	SORBS2	1.409	2.655	9.67E-06
NPAS2	1.584	2.998	2.22E-05	ENOX1	1.408	2.653	4.11E-08
CYP1B1-AS1	1.581	2.991	0.000212729	CCDC85C	1.402	2.643	0.000177813
SHROOM2	1.576	2.981	0.000568851	SMOX	1.401	2.640	1.09E-05
DAPK1	1.573	2.976	9.63E-09	KCNAB3	1.394	2.629	5.68E-05
NAPEPLD	1.573	2.975	2.32E-11	ANO9	1.394	2.628	2.46E-06
CIDEA	1.572	2.973	9.22E-07	LOC100506314	1.390	2.621	0.004140587
TTC22	1.569	2.967	0.000629754	PROSER2-AS1	1.389	2.619	0.000192088
RGS7BP	1.569	2.967	0.00026728	ROBO3	1.389	2.618	1.88E-13
SLC16A1	1.569	2.967	1.58E-07	RAB15	1.388	2.618	8.04E-06
CNTN4	1.566	2.960	0.001103455	RBP1	1.388	2.616	2.51E-09
PITPNM3	1.565	2.959	4.83E-05	ZNF540	1.386	2.614	9.59E-08
MUC1	1.565	2.959	0.000131893	ARHGEF4	1.385	2.612	1.64E-17
SPTB	1.563	2.955	2.44E-06	GAS1	1.380	2.602	3.34E-06

SUPPLEMENTARY DATA

HEG1	1.373	2.590	7.77E-07
HR	1.372	2.588	8.56E-06
C3orf52	1.371	2.586	0.001612767
SLC23A3	1.370	2.585	5.99E-05
FER1L4	1.367	2.579	0.000769576
SOLE	1.363	2.573	0.001169571
AOX1	1.362	2.570	0.000712154
ADH1C	1.354	2.556	1.44E-09
AKAP6	1.351	2.550	0.000119681
IGF2	1.351	2.550	5.14E-09
EML5	1.349	2.548	0.002839865
SLC8A1	1.346	2.543	3.16E-07
ABCB1	1.346	2.543	8.58E-05
GCNT1	1.346	2.542	0.00438264
EBF4	1.344	2.538	1.41E-08
ZNF334	1.343	2.537	6.23E-06
PTX3	1.340	2.531	0.0044047
FAAH2	1.338	2.527	0.004922909
SNAP25	1.333	2.519	0.007960526
GDF5	1.330	2.514	0.000765141
CYP39A1	1.327	2.509	2.03E-07
LOC101929880	1.324	2.504	8.41E-05
FZD3	1.322	2.500	2.68E-06
FZD1	1.318	2.493	5.82E-05
RASL10B	1.316	2.489	7.51E-06
PHYHIP	1.314	2.486	3.41E-05
AZGP1	1.312	2.483	2.73E-05
STAP2	1.309	2.478	1.15E-06
DTX3	1.309	2.478	5.74E-08
ANXA3	1.303	2.467	1.15E-11
NRIP2	1.302	2.466	0.001588475
ZC3HAV1L	1.302	2.466	1.95E-06
CLEC4F	1.295	2.454	0.000912815
LOC100507283	1.290	2.445	7.62E-05
AMMECR1	1.288	2.442	2.76E-05
ALDH1A1	1.288	2.442	1.90E-07
ARL4D	1.287	2.440	0.00043071
PIEZ02	1.282	2.432	0.003882538
P4HA3	1.276	2.422	0.000510819
CLUHP3	1.276	2.422	1.44E-09
DFNA5	1.274	2.418	4.21E-05
PPP1R13L	1.269	2.410	2.97E-06
MPZL2	1.267	2.407	0.000424168
RTKN	1.262	2.399	3.60E-07
SDK2	1.262	2.399	0.000948508
AXIN2	1.257	2.391	0.000371186
F2RL3	1.256	2.387	0.001243001
EMB	1.254	2.386	5.61E-05
SCN2B	1.254	2.385	0.002044139
SALL2	1.252	2.382	0.000163281
CCDC120	1.250	2.378	1.50E-06
ALDH8A1	1.244	2.369	0.002694438
SNHG23	1.240	2.363	0.002379191
KCNJ12	1.237	2.358	8.88E-06
RAP1GAP	1.235	2.354	0.007285943
DISP1	1.235	2.354	0.000270447
CAPN6	1.234	2.352	0.001345247
TRO	1.229	2.343	5.15E-05
PLCB1	1.228	2.343	1.45E-05
TMEM98	1.228	2.342	5.03E-05

CELSR2	1.223	2.334	6.54E-08
KCNH3	1.220	2.330	0.005431742
PROSER2	1.217	2.324	6.63E-07
HOMER1	1.213	2.319	0.00478756
LETM2	1.213	2.318	0.00131575
MIAT	1.213	2.318	2.36E-07
PAPLN	1.213	2.318	2.07E-11
LPAR5	1.212	2.316	0.000354899
DISP2	1.211	2.315	0.000451846
FGF1	1.211	2.315	0.00043407
BAI3	1.204	2.304	0.007361917
PRKG1	1.204	2.304	5.90E-07
PODXL	1.203	2.303	2.20E-05
TMOD1	1.203	2.302	1.98E-09
PRODH	1.203	2.302	0.000977729
ARAP2	1.203	2.301	0.000941854
HOXB5	1.200	2.297	1.19E-06
ACOT11	1.195	2.290	6.13E-05
FAM150B	1.193	2.287	0.003057492
FAM83H	1.193	2.286	0.000214603
ATP7B	1.192	2.284	3.62E-07
ARHGEF25	1.191	2.283	9.00E-09
H19	1.191	2.283	1.52E-06
ATAD3C	1.190	2.281	9.17E-05
MMP23B	1.188	2.279	0.000917198
VEGFC	1.185	2.273	1.33E-09
GPD1L	1.184	2.272	6.97E-09
RAB38	1.182	2.269	0.003478029
RTN4R	1.171	2.252	0.004563437
MEIS2	1.171	2.251	5.33E-08
SAMD5	1.170	2.250	0.002180963
HPSE	1.169	2.248	8.69E-05
NR2F1-AS1	1.167	2.246	1.75E-07
BACH2	1.165	2.243	0.000131818
MOV10L1	1.163	2.240	0.006396027
SULT1C4	1.163	2.239	2.24E-07
DDR1	1.162	2.238	2.44E-08
ABO	1.157	2.230	0.00279902
PPP1R3C	1.157	2.230	1.91E-05
TEAD3	1.154	2.225	7.57E-17
NRXN2	1.154	2.225	0.000928869
E2F5	1.154	2.225	0.000152647
INTU	1.152	2.222	6.30E-11
ATP1A2	1.148	2.217	0.000320435
C10orf2	1.146	2.212	4.19E-05
EPHB6	1.144	2.210	3.36E-07
LSR	1.141	2.206	2.76E-05
BOC	1.141	2.205	1.78E-08
IGSF1	1.140	2.203	4.96E-05
PITX3	1.134	2.194	0.006342688
FZD7	1.132	2.191	9.13E-05
CASC10	1.131	2.191	0.000726885
ZNF676	1.131	2.190	0.002391251
PITX1	1.129	2.186	0.002570248
PTPN13	1.128	2.185	1.11E-10
SLC25A29	1.127	2.185	3.79E-10
PIP5K1B	1.126	2.183	0.000168076
GPR171	1.121	2.175	0.000838551
CDCA7L	1.120	2.173	2.51E-05
PYGM	1.118	2.171	2.87E-07

SUPPLEMENTARY DATA

LINC00649	1.113	2.162	0.000144629
GRB14	1.112	2.162	0.003923994
ENPP5	1.112	2.162	0.003848429
SLC44A3	1.111	2.160	4.22E-07
NKD1	1.108	2.156	0.001566659
CMAHP	1.107	2.154	5.69E-05
CFAP58	1.105	2.151	0.000685922
HOXB6	1.105	2.151	9.90E-06
TAS2R5	1.105	2.151	0.00224524
LOC100129917	1.098	2.140	4.86E-05
SLC4A3	1.098	2.140	1.03E-06
SCHIP1	1.097	2.139	0.008666209
HYDIN	1.094	2.134	0.000165591
MIR1247	1.092	2.131	1.05E-05
RGS17	1.088	2.126	0.001646449
TMEM9B-AS1	1.088	2.125	1.03E-05
LOC101929767	1.087	2.125	0.000257878
PDE10A	1.087	2.125	0.000126749
PEG3	1.087	2.125	5.58E-07
SIX4	1.085	2.121	0.000574475
ZNF285	1.084	2.120	8.23E-05
CCR2	1.084	2.120	8.84E-05
MAMDC4	1.077	2.109	1.19E-06
EBF2	1.075	2.107	1.74E-05
CNKS1	1.075	2.107	0.002084613
PON3	1.073	2.103	0.00024286
BNC2	1.072	2.103	3.45E-07
REC8	1.072	2.102	0.003535166
C3	1.068	2.097	0.001680439
GPR173	1.066	2.094	0.000310244
EYA2	1.064	2.090	4.86E-09
SH2D1A	1.063	2.089	0.000270679
TAF1A	1.057	2.081	1.86E-07
SHC4	1.057	2.080	0.008011675
GRAMD1C	1.055	2.078	0.0086907
AKAP3	1.055	2.077	0.003167618
C2orf40	1.054	2.076	8.28E-06
ELFN1	1.050	2.071	0.001413688
TMEM30B	1.050	2.070	3.08E-06
VEGFA	1.049	2.069	5.26E-07
IGSF3	1.048	2.067	0.001264132
FAM188B	1.044	2.062	0.000178057
GJC2	1.044	2.062	0.00085742
LOC90768	1.043	2.060	0.001433256
CYP1B1	1.040	2.056	5.44E-05
TPD52L1	1.040	2.056	9.40E-07
NGFR	1.039	2.055	3.45E-07
CDK20	1.038	2.054	8.94E-06
POMC	1.038	2.053	0.000153835
PLAG1	1.037	2.052	0.000665148
SLC26A4	1.036	2.050	0.000763604
SCN3B	1.035	2.050	9.94E-06
PCSK4	1.034	2.047	0.000332704
MIR100HG	1.032	2.044	3.14E-06
LMNTD2	1.029	2.041	0.000433341
CCDC102B	1.027	2.038	1.33E-05
HSD17B7	1.027	2.038	0.000159402
HCG25	1.023	2.032	0.005833722
MAPK10	1.023	2.032	1.98E-06
PDE1A	1.022	2.031	2.89E-08

SLC9A7P1	1.020	2.027	0.001377505
CDH23	1.018	2.026	1.04E-07
LTBP4	1.018	2.025	3.34E-05
KLF3-AS1	1.018	2.025	0.000151344
CNKS1	1.015	2.021	0.00020462
ZNF781	1.015	2.021	0.000134713
LEF1	1.015	2.021	0.000613317
GNG7	1.013	2.018	8.47E-07
LOC202181	1.013	2.018	0.000581051
SLC7A2	1.012	2.016	0.001246274
LOC100132077	1.011	2.015	0.000130992
GXYLT2	1.011	2.015	2.10E-07
CPE	1.010	2.014	0.0030303
PPARGC1B	1.009	2.013	0.000691014
BBS12	1.008	2.011	0.001356354
MRGPRF-AS1	1.006	2.009	0.00313233
FAM227B	1.005	2.007	0.005132113
ATP1B1	1.003	2.004	0.000253122
SUCO	1.002	2.003	1.16E-06
ZNF488	1.000	2.000	0.005550009
JAG2	-1.001	-2.001	0.000243263
VENTX	-1.002	-2.003	3.43E-05
ADAMTS2	-1.011	-2.015	9.43E-09
HAACL1	-1.011	-2.015	1.37E-12
MXRA5	-1.012	-2.017	0.000298852
RCAN2	-1.013	-2.018	6.73E-06
HOXD4	-1.013	-2.018	0.000350223
PLXNB3	-1.014	-2.019	0.007394074
POSTN	-1.015	-2.021	7.27E-05
NINJ2	-1.019	-2.027	4.89E-06
DUSP10	-1.019	-2.027	0.000142274
ASS1	-1.022	-2.031	1.32E-08
CCDC170	-1.023	-2.032	3.07E-06
CXXC5	-1.026	-2.037	9.51E-09
NMUR1	-1.028	-2.039	0.000248339
KLHL31	-1.030	-2.042	3.63E-06
AFF3	-1.030	-2.042	3.52E-06
FAM72A	-1.031	-2.044	0.001859782
FAM69B	-1.035	-2.050	1.60E-05
SCNN1B	-1.036	-2.050	7.10E-05
LRRC32	-1.036	-2.051	0.000707893
HDC	-1.039	-2.055	0.000380549
TPRG1	-1.040	-2.056	1.73E-05
ANGPTL4	-1.044	-2.062	0.000926436
LINC00341	-1.045	-2.064	1.55E-09
OLFML2A	-1.046	-2.064	0.000120113
FABP3	-1.048	-2.068	0.004862606
VIPR1	-1.049	-2.069	5.17E-05
EOGT	-1.050	-2.070	9.17E-09
MELK	-1.056	-2.079	0.004344153
ALCAM	-1.057	-2.080	0.001442261
RHOXF1	-1.059	-2.083	0.000813217
ITGAX	-1.059	-2.084	0.000279625
VIM-AS1	-1.060	-2.086	0.000314427
CLCA2	-1.060	-2.086	0.000152413
MIR214	-1.061	-2.086	0.00464536
TMEM119	-1.061	-2.087	1.06E-08
PHKG1	-1.062	-2.088	0.000348548
C4orf19	-1.066	-2.093	4.71E-06
SREBF1	-1.066	-2.094	2.81E-05

SUPPLEMENTARY DATA

PPP2R1B	-1.066	-2.094	4.76E-07
PNMAL2	-1.066	-2.094	0.000126661
MYADM	-1.068	-2.097	0.007356341
NRIP3	-1.069	-2.098	0.003790608
FBLN2	-1.069	-2.099	3.83E-05
SULT1C2	-1.070	-2.100	0.001821952
KIAA1683	-1.070	-2.100	7.56E-05
GLDN	-1.073	-2.104	2.14E-06
GNG2	-1.076	-2.107	2.21E-09
ACE	-1.077	-2.109	1.79E-05
CSDM2	-1.077	-2.110	0.00724192
RGCC	-1.077	-2.110	5.26E-05
MGLL	-1.086	-2.123	2.11E-06
THRSP	-1.088	-2.126	4.96E-05
EYS	-1.090	-2.129	0.000314142
SLC5A4	-1.090	-2.129	0.005577848
CSPG4	-1.090	-2.129	7.85E-06
SLC35G1	-1.094	-2.135	1.29E-05
MEGF9	-1.095	-2.136	8.80E-07
LIPE-AS1	-1.099	-2.143	0.000438699
DUSP4	-1.102	-2.146	0.000966355
P2RY12	-1.104	-2.149	1.38E-05
COL6A3	-1.105	-2.151	1.34E-05
SATB2	-1.107	-2.154	1.68E-06
ANPEP	-1.108	-2.155	8.76E-07
DCLK1	-1.109	-2.157	2.89E-06
AKR1B15	-1.110	-2.159	0.001168028
FAT1	-1.114	-2.164	4.69E-08
FGF13	-1.117	-2.169	1.62E-06
CYP26B1	-1.119	-2.171	1.95E-05
PRRX1	-1.122	-2.177	5.37E-10
FILIP1L	-1.124	-2.180	0.000211947
ANK2	-1.127	-2.184	6.04E-06
COL5A2	-1.130	-2.189	1.59E-09
PLBD2	-1.132	-2.192	5.79E-11
MSX1	-1.132	-2.192	0.000531437
TNN	-1.134	-2.195	0.00170767
TLE2	-1.138	-2.201	3.56E-09
MGAT3	-1.138	-2.201	7.30E-08
DOCK6	-1.140	-2.204	2.13E-07
ROBO2	-1.140	-2.204	0.000503008
PTGES	-1.141	-2.205	6.93E-05
LINC00312	-1.145	-2.211	0.002896928
MMP2	-1.148	-2.216	1.64E-05
LOC100996427	-1.151	-2.221	0.004633179
RBM3	-1.152	-2.222	1.43E-09
P2RX1	-1.154	-2.226	0.000192984
CILP	-1.156	-2.228	0.0011356
CES3	-1.156	-2.229	0.000265402
ALPL	-1.156	-2.229	0.000229465
CSF2RA	-1.157	-2.230	2.24E-07
CD83	-1.158	-2.231	0.005135592
DNASE1L3	-1.158	-2.232	0.000299136
SERINC2	-1.159	-2.233	6.99E-07
RAB42	-1.161	-2.237	2.21E-06
CCR7	-1.166	-2.244	0.00459268
SNCG	-1.167	-2.246	1.72E-06
ASAHI	-1.168	-2.247	3.47E-08
DHRS11	-1.168	-2.248	8.92E-10
LAMP3	-1.170	-2.250	0.005890934
CD52	-1.173	-2.254	0.001950559
COL4A4	-1.174	-2.257	0.003811172
HTRA3	-1.178	-2.263	0.000812087
FGF11	-1.180	-2.265	2.97E-05
NR5A2	-1.184	-2.271	3.22E-06
MYH1	-1.184	-2.273	0.001715648
CEP55	-1.186	-2.275	0.006031582
TCTEX1D1	-1.186	-2.276	0.003449434
SPARC	-1.187	-2.277	1.82E-06
LOC101929726	-1.194	-2.288	1.49E-06
NRXN3	-1.195	-2.289	0.000352389
APOE	-1.198	-2.294	9.41E-05
FAM26E	-1.205	-2.306	3.39E-07
CYP2B7P	-1.207	-2.309	0.000737495
NLRP3	-1.213	-2.319	0.000818546
AKR1C3	-1.216	-2.322	3.88E-08
ENDOU	-1.217	-2.324	0.002682675
VIT	-1.218	-2.327	1.25E-05
LINC01140	-1.222	-2.332	6.24E-06
UBE2QL1	-1.224	-2.337	0.00074622
C16orf54	-1.227	-2.341	5.18E-06
TMEM37	-1.228	-2.342	5.57E-09
CACNA2D1	-1.229	-2.344	2.67E-07
ZFAT	-1.229	-2.345	1.19E-06
COL5A3	-1.231	-2.348	4.18E-08
REEP6	-1.231	-2.348	5.35E-05
GYPE	-1.235	-2.353	0.004714015
FADS3	-1.242	-2.365	3.07E-07
ELANE	-1.243	-2.367	0.000697785
PNPLA3	-1.243	-2.368	0.001419198
LPHN3	-1.246	-2.371	0.000256476
SHC3	-1.246	-2.371	0.002408959
OASL	-1.251	-2.380	0.000249464
ADAMTS10	-1.252	-2.381	1.32E-10
AKR1C1	-1.257	-2.390	8.00E-11
NDNF	-1.262	-2.399	0.000319109
NOVA1	-1.264	-2.402	1.74E-10
NTRK2	-1.268	-2.409	1.28E-09
TRDN	-1.271	-2.413	0.005500096
CD44	-1.271	-2.414	1.32E-05
ATP10A	-1.273	-2.416	6.07E-09
RANBP17	-1.277	-2.424	0.000778772
SEMA3E	-1.279	-2.427	0.000736528
FAM171A2	-1.280	-2.429	3.21E-06
MYO1H	-1.282	-2.432	0.001157734
KCNA2	-1.288	-2.443	0.00059853
ADRA2A	-1.289	-2.444	7.86E-06
FOXF2	-1.290	-2.445	0.000602706
FMOD	-1.293	-2.451	1.33E-09
TREM2	-1.295	-2.454	0.003317928
SIGLEC17P	-1.299	-2.461	0.000753858
EPHB2	-1.304	-2.469	2.77E-05
MAP7D2	-1.316	-2.489	0.000636064
SEL1L2	-1.317	-2.491	5.64E-07
SPP1	-1.323	-2.501	0.002482277
LOC101929219	-1.329	-2.513	0.000157034
IL20RB	-1.337	-2.526	1.28E-06
CDH20	-1.338	-2.527	4.00E-05
HTR2B	-1.338	-2.528	6.96E-05
MEOX1	-1.341	-2.533	1.00E-06

SUPPLEMENTARY DATA

C10orf90	-1.344	-2.538	8.52E-08	PITX2	-1.580	-2.989	0.00161148
NANOS1	-1.345	-2.540	6.52E-11	ST7-AS1	-1.584	-2.997	9.06E-07
HOXC5	-1.345	-2.540	5.60E-06	TENM4	-1.584	-2.997	8.73E-11
TRIM6	-1.346	-2.542	9.41E-08	DGAT2	-1.589	-3.009	8.67E-08
SLC18A2	-1.347	-2.544	0.008459611	LOXL2	-1.591	-3.013	5.15E-13
HRCT1	-1.348	-2.546	4.81E-08	COL15A1	-1.593	-3.017	4.88E-10
RND3	-1.352	-2.553	0.000200594	ACR	-1.595	-3.020	0.001695422
VCAN	-1.356	-2.560	3.59E-05	LOC100130938	-1.607	-3.045	0.0005366
COL3A1	-1.356	-2.560	8.39E-06	LINC01116	-1.609	-3.051	4.58E-06
TRIM63	-1.361	-2.569	0.008238247	TUBB2A	-1.614	-3.061	6.67E-07
ADORA1	-1.362	-2.570	5.81E-09	IRF4	-1.631	-3.097	6.00E-05
ITGA11	-1.383	-2.608	0.000334559	KLF4	-1.631	-3.098	0.001236721
NOV	-1.384	-2.610	4.04E-06	TF	-1.641	-3.118	9.56E-09
RBP4	-1.387	-2.616	5.00E-09	LRRC4C	-1.645	-3.126	9.97E-07
KLHL30	-1.387	-2.616	5.91E-06	TTC39A	-1.652	-3.143	5.45E-05
ODF3L1	-1.389	-2.619	0.000291959	FGFR2	-1.662	-3.164	1.28E-09
SOX7	-1.390	-2.621	0.00205148	PPP1R1B	-1.662	-3.165	1.33E-12
APOC1	-1.392	-2.624	0.000333853	ADAMTS18	-1.667	-3.175	2.59E-05
ECM1	-1.393	-2.627	6.29E-07	KRT14	-1.690	-3.227	9.56E-05
TBX18	-1.394	-2.628	2.02E-08	AR	-1.692	-3.230	1.44E-21
TACR1	-1.395	-2.630	1.26E-05	TTYH1	-1.693	-3.233	0.006263006
HPGD	-1.395	-2.631	0.000331174	CYP2A6	-1.725	-3.306	1.06E-07
ABCC3	-1.402	-2.642	4.60E-08	ZFHX4-AS1	-1.725	-3.306	5.08E-05
MAP1A	-1.409	-2.656	8.93E-10	WISP2	-1.727	-3.310	1.94E-18
HOXC4	-1.418	-2.672	4.13E-06	GLIPR2	-1.740	-3.341	4.15E-13
PLA2G7	-1.418	-2.673	3.64E-05	CMA1	-1.750	-3.363	0.000347227
GRIA3	-1.421	-2.677	7.65E-05	ZNF541	-1.750	-3.365	5.03E-08
IFITM10	-1.421	-2.678	7.26E-10	OSR2	-1.752	-3.369	1.02E-14
ACP5	-1.431	-2.696	1.89E-06	HSD17B13	-1.768	-3.405	1.07E-05
TPSAB1	-1.435	-2.705	2.57E-05	LOC101929513	-1.777	-3.427	5.97E-11
TPPP3	-1.439	-2.712	1.29E-05	HOXD8	-1.778	-3.429	2.74E-09
QPCT	-1.440	-2.712	4.57E-06	BHMT	-1.785	-3.445	1.35E-07
NTRK3	-1.449	-2.731	0.000168213	NCAPH	-1.789	-3.455	4.05E-05
DHRS9	-1.451	-2.735	1.26E-07	CSN1S1	-1.792	-3.462	0.007787086
AOC4P	-1.457	-2.746	1.80E-06	IRF8	-1.818	-3.527	2.10E-21
MMP17	-1.463	-2.757	1.73E-07	CCL22	-1.826	-3.546	6.41E-05
NNAT	-1.467	-2.765	5.06E-08	OLFM2	-1.841	-3.582	6.88E-18
CSTA	-1.481	-2.792	6.44E-16	MMP8	-1.848	-3.601	0.004309718
CXCL14	-1.489	-2.806	2.21E-06	MAB21L1	-1.852	-3.609	1.67E-05
CTSG	-1.489	-2.807	0.000990259	PROK1	-1.853	-3.612	3.79E-05
ENPP2	-1.505	-2.837	7.72E-16	CCL13	-1.860	-3.629	1.24E-06
PLP1	-1.511	-2.850	4.25E-07	C5orf64	-1.862	-3.636	1.87E-07
ITIH5	-1.519	-2.865	1.21E-09	SLC2A5	-1.877	-3.674	1.74E-05
PNMA3	-1.524	-2.875	2.59E-05	LOC101930011	-1.882	-3.685	5.51E-05
FAM180B	-1.531	-2.891	0.000121638	PTGFR	-1.885	-3.693	4.10E-08
ADAM12	-1.531	-2.891	1.57E-15	SMOC1	-1.894	-3.717	5.57E-09
CD177	-1.532	-2.892	4.92E-05	NRN1	-1.905	-3.744	3.65E-16
TPSB2	-1.537	-2.902	6.13E-06	P2RX6P	-1.911	-3.762	3.33E-05
MME	-1.540	-2.908	6.45E-10	PDE11A	-1.912	-3.763	3.79E-08
CD300LB	-1.541	-2.909	8.67E-05	GAS2L2	-1.932	-3.815	3.67E-10
DRD1	-1.547	-2.923	0.000471014	ITGBL1	-1.934	-3.821	1.79E-05
PTCH2	-1.549	-2.926	1.22E-09	LINC00632	-1.939	-3.836	4.77E-16
CETP	-1.550	-2.929	0.001998324	TMEM139	-1.945	-3.850	1.77E-07
S100A4	-1.553	-2.935	4.56E-10	SLC6A2	-1.962	-3.897	3.89E-06
FAT2	-1.557	-2.942	5.39E-06	KCNQ3	-1.966	-3.908	1.13E-05
GOLGA7B	-1.566	-2.960	6.64E-06	ANGPTL5	-1.967	-3.909	8.00E-06
IL1RN	-1.571	-2.971	0.005237466	AADAC	-1.968	-3.913	0.005095763
ANKRD30A	-1.572	-2.972	6.81E-06	HS3ST2	-1.979	-3.942	1.53E-07
CTHRC1	-1.577	-2.983	2.69E-07	PHACTR3	-1.988	-3.968	0.000679425
CRIP1	-1.579	-2.987	1.67E-05	CNTN6	-2.006	-4.016	4.90E-05

SUPPLEMENTARY DATA

ABCB4	-2.007	-4.020	7.58E-10
ESR2	-2.014	-4.038	2.15E-09
DIO2	-2.014	-4.039	8.19E-07
LOC101928123	-2.020	-4.055	9.18E-07
SLAMF9	-2.022	-4.060	0.001296595
SEMA3G	-2.022	-4.062	1.96E-12
XPNPEP2	-2.057	-4.160	2.14E-09
PRR16	-2.059	-4.166	1.17E-06
LBP	-2.066	-4.186	7.57E-10
DNASE2B	-2.078	-4.221	0.002489376
FOXP3	-2.090	-4.257	0.000125082
HPSE2	-2.092	-4.262	5.11E-07
CCL18	-2.104	-4.299	3.54E-06
LINC01070	-2.105	-4.301	3.96E-07
TENM1	-2.122	-4.352	2.29E-29
HORMAD2-AS1	-2.142	-4.413	1.15E-06
NOTCH3	-2.148	-4.433	3.41E-10
CCL19	-2.158	-4.464	3.90E-05
SPOCD1	-2.169	-4.498	8.26E-09
MFAP5	-2.176	-4.518	3.68E-07
CHIT1	-2.238	-4.718	0.000185209
CD248	-2.263	-4.799	6.93E-16
STAC	-2.270	-4.822	1.37E-09
CCND1	-2.273	-4.832	5.29E-23
PEMT	-2.284	-4.872	5.73E-24
CDC20	-2.298	-4.917	3.93E-08
DEFB1	-2.302	-4.933	2.33E-10
TM4SF19	-2.306	-4.944	1.23E-05
KLHDC7A	-2.350	-5.097	5.04E-06
HMCN2	-2.361	-5.138	2.40E-07
GLI1	-2.363	-5.145	6.53E-11
MMP9	-2.371	-5.174	6.56E-08
MMP12	-2.393	-5.252	0.001352337
DMRT2	-2.427	-5.377	4.91E-11
LINC01239	-2.428	-5.380	1.23E-12
MS4A6E	-2.439	-5.424	0.000310847
ANO3	-2.452	-5.472	2.57E-17
FGF13-AS1	-2.471	-5.543	1.22E-11
C14orf80	-2.471	-5.544	1.44E-11
TWIST1	-2.476	-5.562	9.99E-27
ATP6V0D2	-2.486	-5.604	0.000514849
ALDOC	-2.496	-5.640	4.47E-28
GALNT13	-2.499	-5.651	9.24E-26
SIX1	-2.536	-5.801	3.99E-12
LOC728339	-2.605	-6.084	4.60E-08
HOXD-AS2	-2.614	-6.122	2.63E-10
LAMB3	-2.647	-6.264	8.39E-22
ALPK2	-2.680	-6.408	4.81E-06
HOXC6	-2.686	-6.433	2.54E-33
LINC01010	-2.688	-6.446	1.03E-06
HOXA9	-2.711	-6.546	1.84E-11
IGFN1	-2.768	-6.813	2.20E-10
GABRA2	-2.793	-6.929	1.96E-10
COL11A1	-2.821	-7.065	8.55E-07
GYS2	-2.856	-7.240	5.31E-11
OXT	-2.879	-7.356	8.32E-11
BBOX1	-2.881	-7.366	9.53E-14
SHOX2	-2.951	-7.733	3.28E-11
CNTNAP4	-2.974	-7.857	1.46E-09
P2RX6	-2.982	-7.904	2.37E-14
LOC100506869	-3.001	-8.003	2.44E-06
MMP7	-3.003	-8.014	1.50E-06
PRKG2	-3.008	-8.047	2.27E-11
GDF10	-3.016	-8.091	1.71E-15
KIAA1549L	-3.026	-8.146	1.09E-12
EN1	-3.047	-8.263	1.37E-10
PCDH7	-3.087	-8.498	6.83E-35
EMX2OS	-3.089	-8.509	9.16E-12
IRX3	-3.103	-8.595	1.27E-27
SELE	-3.109	-8.626	0.004829152
URAD	-3.141	-8.824	2.29E-08
FNDC1	-3.147	-8.856	5.15E-06
HOXA10	-3.180	-9.061	3.84E-23
XG	-3.181	-9.068	1.04E-14
LUZP2	-3.225	-9.351	4.08E-13
LINC01484	-3.252	-9.526	2.30E-10
BMP5	-3.335	-10.088	3.93E-08
C19orf80	-3.450	-10.926	2.62E-12
SPAG17	-3.464	-11.037	4.36E-16
MMP27	-3.498	-11.296	1.09E-08
CLIC6	-3.505	-11.356	1.03E-18
UNC13C	-3.652	-12.573	1.64E-07
DKK2	-3.791	-13.847	3.87E-17
KRT79	-3.855	-14.466	3.27E-18
EMX2	-3.876	-14.685	5.11E-14
TBX5-AS1	-3.901	-14.942	1.03E-12
TBX15	-3.944	-15.391	1.22E-22
KRT16	-4.032	-16.354	1.98E-10
AQP4	-4.140	-17.626	1.37E-06
CSMD1	-4.198	-18.359	6.32E-08
HOXC9	-4.488	-22.441	4.16E-61
NRCAM	-4.518	-22.910	9.04E-24
CRNDE	-4.537	-23.214	1.44E-49
IRX1	-4.698	-25.960	9.28E-31
HOXC-AS1	-4.840	-28.638	2.52E-24
SERPINA5	-4.854	-28.929	1.16E-31
TBX5	-4.875	-29.337	7.51E-11
HOXA11	-4.894	-29.730	3.94E-11
GDA	-4.926	-30.397	3.02E-07
LINC01305	-4.928	-30.444	1.14E-10
IRX2	-4.929	-30.454	8.13E-32
C5orf38	-4.957	-31.065	1.26E-40
EGFL6	-5.324	-40.059	9.89E-22
HOXA11-AS	-5.604	-48.645	4.94E-12
HOXA10-AS	-5.974	-62.838	1.38E-17
HOXC8	-5.999	-63.937	2.00E-72
DMRT3	-6.110	-69.069	1.66E-54
MYEOV	-6.227	-74.910	3.51E-52
IRX5	-6.250	-76.102	1.51E-39
STMN2	-7.234	-150.555	2.53E-52
PAX3	-7.712	-209.614	2.35E-20
HOXC10	-7.939	-245.414	3.21E-49
SIM1	-8.722	-422.387	9.37E-53

SUPPLEMENTARY DATA

Supplementary Table S2. Microarray analysis of differentially expressed genes in the two depots of ASCs

Supplementary Table S2A. Genes predominantly expressed in SC-ASCs

Column #	Gene	Gene Name	Fold Change	Location
8766	HOXA9	Homeobox A9	10.3754	Nucleus
25085	MME	Membrane Metallo-Endopeptidase	5.94013	Cell membrane
25166	MOXD1	Monooxygenase, DBH-Like 1	5.34089	Endoplasmic reticulum membrane
33840	XG	Xg Blood Group	4.60012	Cell membrane
4362	COLEC12	Collectin Sub-Family Member 12	4.56131	Membrane
23640	LPXN	Leupaxin	4.39452	Cytoplasm. Cell junction, focal adhesion. Nucleus. Cytoplasm, perinuclear region
4772	CXCL5	Chemokine (C-X-C Motif) Ligand 5	4.27017	Secreted
12638	IRX5	Iroquois Homeobox 5	4.26647	Nucleus
12635	IRX2	Iroquois Homeobox 2	4.21172	Nucleus
8756	HOXA10	Homeobox A10	4.05738	Nucleus
12636	IRX3	Iroquois Homeobox 3	4.02371	Nucleus
18655	LOC643911		3.78673	
12180	HSPB7	Heat Shock 27kDa Protein Family, Member 7	3.74826	Cytoplasm. Nucleus. Nucleus, Cajal body
7346	FOXQ1	Forkhead Box Q1	3.67621	Nucleus
4374	COMP	Cartilage Oligomeric Matrix Protein	3.54088	Secreted, extracellular space, extracellular matrix
5935	EMX2	Empty Spiracles Homeobox 2	3.50928	Nucleus
2774	C4orf31	Neuron-Derived Neurotrophic Factor	3.4722	Secreted
5955	ENPP1	Ectonucleotide Pyrophosphatase/Phosphodiesterase 1	3.40718	Cell membrane, Secreted
8152	GREM2	Gremlin 2, DAN Family BMP Antagonist	3.30795	Secreted
28768	RASD2	RASD Family, Member 2	3.30238	Cell membrane
32269	TMEM119	Transmembrane Protein 119	3.27975	Membrane
25682	NCALD	Neurocalcin Delta	3.26326	Cytoplasm
7279	FNDC1	Fibronectin Type III Domain Containing 1	3.2159	Secreted
27570	PITX2	Paired-Like Homeodomain 2	3.21041	Nucleus
29192	RNF144	Ring Finger Protein 144A	3.17023	Membrane

SUPPLEMENTARY DATA

6617	FBN2	Fibrillin 2	3.15436	Secreted, extracellular space, extracellular matrix
20682	LOC649366		3.13088	
5041	DDIT4L	DNA-Damage-Inducible Transcript 4-Like	3.08058	Cytoplasm
29587	S100A4	S100 Calcium Binding Protein A4	2.92341	Nucleus
4529	CRIP1	Cysteine-Rich Protein 1	2.87285	Cytoplasm
21370	LOC651872		2.85677	
8373	HAS1	Hyaluronan Synthase 1	2.84781	Membrane
12411	IL13RA2	Interleukin 13 Receptor, Alpha 2	2.81381	Membrane
7601	GAS1	Growth Arrest-Specific 1	2.80756	Cell membrane
24067	MASP1	Mannan-Binding Lectin Serine Peptidase 1 (C4/C2 Activating Component Of Ra-Reactive Factor)	2.80391	Secreted
30303	SLC1A3	Solute Carrier Family 1 (Glial High Affinity Glutamate Transporter), Member 3	2.77057	Cell membrane
1462	BAALC	Brain And Acute Leukemia, Cytoplasmic	2.72285	Cytoplasm. Membrane.
32530	TNC	Tenascin C	2.71229	Secreted, extracellular space, extracellular matrix
16616	LOC375295		2.71182	
13700	LIMCH1	LIM And Calponin Homology Domains 1	2.65013	
25091	MMP12	Matrix Metallopeptidase 12	2.63736	Secreted, extracellular space, extracellular matrix
12111	HS3ST3A1	Heparan Sulfate (Glucosamine) 3-O-Sulfotransferase 3A1	2.62209	Golgi apparatus membrane
4538	CRISPLD2	Cysteine-Rich Secretory Protein LCCL Domain Containing 2	2.61912	Secreted
4862	CYP26B1	Cytochrome P450, Family 26, Subfamily B, Polypeptide 1	2.6125	Endoplasmic reticulum membrane
12293	IFI44	Interferon-Induced Protein 44	2.60695	Cytoplasm
29193	RNF144A	Ring Finger Protein 144A	2.60681	Membrane
13382	KRT81	Keratin 81	2.58844	
746	ANGPT1	Angiopoietin 1	2.5307	Secreted
8785	HOXC9	Homeobox C9	2.52663	Nucleus
4130	CLDN23	Claudin 23	2.52583	Cell junction, tight junction

SUPPLEMENTARY DATA

8784	HOXC8	Homeobox C8	2.50662	Nucleus
8003	GPNMB	Glycoprotein (Transmembrane) Nmb	2.46843	Cell membrane
16753	LOC389033		2.43817	
31865	TBX15	T-Box 15	2.43457	Nucleus
27097	PCDH18	Protocadherin 18	2.4039	Cell membrane
27807	PODXL	podocalyxin-like	2.40284	Apical cell membrane. Cell projection, lamellipodium
5956	ENPP2	Ectonucleotide Pyrophosphatase/Phosphodiesterase 2	2.30375	Secreted
26393	OLFML2B	Olfactomedin-Like 2B	2.30152	Secreted
7571	GALNT5	UDP-N-Acetyl-Alpha-D-Galactosamine:Polypeptide N-Acetylgalactosaminyltransferase 5	2.30113	Golgi apparatus membrane
8783	HOXC6	Homeobox C6	2.27935	Nucleus
11247			2.26373	
4719	CTSK	Cathepsin K	2.25696	Lysosome
7259	FMN2	Formin 2	2.24998	Cytoplasm, cytoskeleton.
26232	NTNG1	Netrin G1	2.24238	Cell membrane
33115	TWIST1	Twist Basic Helix-Loop-Helix Transcription Factor 1	2.23364	Nucleus
28284	PRRX1	Paired Related Homeobox 1	2.22934	Nucleus
28338	PSG9	Pregnancy Specific Beta-1-Glycoprotein 9	2.21431	Secreted
28334	PSG5	Pregnancy Specific Beta-1-Glycoprotein 5	2.20121	Secreted
4568	CRYAB	Crystallin, Alpha B	2.19852	Cytoplasm. Nucleus
15825	LOC100134 259		2.1713	
28425	PTGER2	Prostaglandin E Receptor 2 (Subtype EP2), 53kDa1	2.1647	Cell membrane
3577	CCRL1		2.14911	
1993	C13orf15	Regulator Of Cell Cycle	2.14396	Cytoplasm. Nucleus. cytoskeleton,,microtubule organizing center, centrosome
11011			2.14379	
29689	SCARA3	Scavenger Receptor Class A, Member 3	2.1299	Endoplasmic reticulum membrane

SUPPLEMENTARY DATA

28332	PSG3	Pregnancy Specific Beta-1-Glycoprotein 3	2.10316	Secreted
28767	RASD1	RAS, Dexamethasone-Induced 1	2.08609	Cell membrane;
857	ANPEP	Alanyl (Membrane) Aminopeptidase	2.06552	Cell membrane;
7577	GALNTL2	UDP-N-Acetyl-Alpha-D-Galactosamine:Polypeptide N-Acetylgalactosaminyltransferase 15	2.06356	Golgi apparatus membrane
33796	WNT5A	Wingless-Type MMTV Integration Site Family, Member 5A	2.04702	Secreted, extracellular space, extracellular matrix
27929	PPAP2B	Phosphatidic Acid Phosphatase Type 2B	2.03889	Golgi apparatus, trans-Golgi network membrane
7140	FLJ42986		2.03817	
24413	MGC87042	STEAP Family Member 1B	2.03319	Membrane
29541	RTTN	rotatin	2.02983	Cytoplasm, cytoskeleton, cilium basal body
12446	IL1RN	Interleukin 1 Receptor Antagonist	2.01802	

SUPPLEMENTARY DATA

Supplementary Table S2B. Genes predominantly expressed in VS-ASCs

Column #	Gene	Gene Name	Fold Change	Location
28871	RBP1	Retinol binding protein 1	8.27516	Cytoplasm
1499	BARX1	BARX Homeobox 1	5.97335	Nucleus
3922	CFI	Complement Factor I	5.43738	Secreted, extracellular space
24419	MGP	Matrix Gla Protein	5.29882	Secreted
28754	RARRES1	Retinoic Acid Receptor Responder (Tazarotene Induced) 1	4.99255	Membrane; Single-pass type II membrane protein
19868	LOC646723		4.92907	
1495	BAPX1	NK3 Homeobox 2	4.48321	Nucleus
12648	ISL1	ISL LIM Homeobox 1	4.10767	Nucleus
23687	LRRC17	Leucine Rich Repeat Containing 17	3.67668	Secreted, extracellular space
4330	COL22A1	Collagen, Type XXII, Alpha 1	3.66019	Secreted, extracellular space, extracellular matrix. Cytoplasm
28755	RARRES2	Retinoic Acid Receptor Responder (Tazarotene Induced) 2	3.61391	Secreted
31910	TCF21	Transcription Factor 21	3.6064	Nucleus
26149	NR2F1	Nuclear Receptor Subfamily 2, Group F, Member 1	3.43103	Nucleus
30019	SFRP1	Secreted Frizzled-Related Protein 1	3.3473	Secreted
12121	HSD11B1	Hydroxysteroid (11-Beta) Dehydrogenase 1	3.28262	Endoplasmic reticulum membrane
23814	LXN	latexin	3.23567	Cytoplasm
7099	FLJ40504		3.21661	
29862	SEL1L3	Suppressor Of Lin-12-Like 3	3.16132	Membrane;
12532	INHBE	Inhibin, Beta E	3.13427	Secreted
29725	SCG2	Secretogranin II	3.08579	Secreted.
28437	PTGS1	Prostaglandin-Endoperoxide Synthase 1	2.98568	Microsome membrane
30021	SFRP4	Secreted Frizzled-Related Protein 4	2.92945	Secreted
27258	PDGFRL	Platelet-Derived Growth Factor Receptor-Like1	2.8967	Secreted
3788	CDKN2B	Cyclin-Dependent Kinase Inhibitor 2B	2.89236	Cytoplasm. Note=Also found in the nucleus
28907	RDH10	Retinol Dehydrogenase 10	2.8607	Microsome membrane;

SUPPLEMENTARY DATA

30197	SIPA1L2	Signal-Induced Proliferation-Associated 1 Like 2	2.85015	
26984	PALM	paralemmin	2.78604	Cell membrane
27601	PKNOX2	PBX/Knotted 1 Homeobox 2	2.77798	Nucleus
13332	KRT18P13	Keratin 18 Pseudogene 13	2.72389	
27640	PLAT	Plasminogen Activator, Tissue	2.72317	Secreted, extracellular space
27782	PNMA2	Paraneoplastic Ma Antigen 2	2.71009	Nucleus
27736	PLXDC2	Plexin Domain Containing 2	2.69031	Membrane
24045			2.66922	
28294	PRSS3	Protease, Serine, 3	2.63793	Secreted
4145	CLEC14A	C-Type Lectin Domain Family 14, Member A	2.63686	Membrane;
12808	KCNAB1	Potassium Voltage-Gated Channel, Shaker-Related Subfamily, Beta Member 1	2.6118	Cytoplasm
4258	CNN1	Calponin 1, Basic, Smooth Muscle	2.59465	
15583	LOC100133609		2.58719	
34086	ZFPM2	Zinc Finger Protein, FOG Family Member 2	2.5533	Nucleus
29947	SERPINA3	Serpin Peptidase Inhibitor, Clade A	2.53396	Secreted
29771	SCRG1	Stimulator Of Chondrogenesis 1	2.50431	Secreted
8763	HOXA5	Homeobox A5	2.49815	Nucleus
8762	HOXA4	Homeobox A4	2.4505	Nucleus
29038	RGS4	Regulator Of G-Protein Signaling 4	2.44932	Cytoplasm
5221	DHRS3	Dehydrogenase/Reductase (SDR Family) Member 3	2.44057	Membrane
26240	NUAK1	NUAK Family, SNF1-Like Kinase, 1	2.42707	Nucleus. Cytoplasm
3153	CACNA1H	Calcium Channel, Voltage-Dependent, T Type, Alpha 1H Subunit	2.40405	Membrane
29817	SDPR	Serum Deprivation Response	2.40157	Cytoplasm, cytosol. Membrane, caveola
32758	TRIB3	Tribbles Pseudokinase 3	2.34972	Nucleus
24272	MFAP4	Microfibrillar-Associated Protein 4	2.34731	Secreted, extracellular space, extracellular matrix
28315	PSAT1	Phosphoserine Aminotransferase 1	2.3457	
9874			2.34024	

SUPPLEMENTARY DATA

28434	PTGIS	Prostaglandin I2	2.33114	Endoplasmic reticulum membrane
25716	NCOA7	Nuclear Receptor Coactivator 7	2.32821	Nucleus
28292	PRSS23	Protease, Serine, 23	2.32593	Secreted
811	ANKRD37	Ankyrin Repeat Domain 37	2.31583	Nucleus. Cytoplasm
3609	CD200	CD200 Molecule	2.30224	Cell membrane;
1257	ATF5	Activating Transcription Factor 5	2.28456	Cytoplasm. Nucleus
8760	HOXA2	Homeobox A2	2.27158	Nucleus
6762	FGF11	Fibroblast Growth Factor 11	2.22401	
6175	F3	Coagulation Factor III	2.21223	Isoform 1: Membrane; Isoform 2: Secreted
8469	HEG1	Heart Development Protein With EGF-Like Domains 1	2.15537	Cell membrane Cell junction
23139	LOC729779		2.15515	
30259	SLC12A8	Solute Carrier Family 12, Member 8	2.14658	Membrane
1544	BCHE	butyrylcholinesterase	2.14589	Secreted
27283	PDPN	podoplanin	2.14424	Membrane
32942	TSPAN8	Tetraspanin 8	2.09557	Membrane
871	ANXA3	Annexin A3	2.08972	Cytoplasm, plasma membrane
4445	CPA4	Carboxypeptidase A4	2.08923	Secreted
23807	LUM	lumican	2.08302	Secreted, extracellular space, extracellular matrix
31559	STXBP6	Syntaxin Binding Protein 6	2.08267	Cytoplasm. Membrane; Peripheral membrane protein
31114	SOST	sclerostin	2.07272	Secreted, extracellular space, extracellular matrix
1223	ASNS	Asparagine Synthetase	2.06652	cytosol
12124	HSD17B1	Hydroxysteroid (17-Beta) Dehydrogenase 1	2.06221	Cytoplasm
23407	LOC730994		2.05949	
27402	PGM5	Phosphoglucomutase 5	2.05847	Cell junction, adherens junction. Cytoplasm, cytoskeleton
33629	WARS	Tryptophanyl-tRNA Synthetase	2.05736	Cytoplasm
33267	UCHL1	Ubiquitin Carboxyl-Terminal Esterase L1	2.04663	Cytoplasm. Endoplasmic reticulum membrane
29877	SEMA3C	Sema Domain, Immunoglobulin Domain (Ig), Short Basic Domain, Secreted,	2.02941	Secreted

SUPPLEMENTARY DATA

		(Semaphorin) 3C		
12055			2.02564	
876	ANXA8	Annexin A8	2.02242	cytosol
24219	MEIS1	Meis Homeobox 1	2.02231	Nucleus
22624	LOC728473		2.00756	
3755	CDH6	Cadherin 6, Type 2, K-Cadherin	2.00627	Cell membrane;
27277	PDLM3	PDZ And LIM Domain 3	2.00595	Cytoplasm, myofibril, sarcomere, Z line
27591	PKIA	Protein Kinase (CAMP-Dependent, Catalytic) Inhibitor Alpha	2.00167	Nucleus, cytoplasm

SUPPLEMENTARY DATA

Supplementary Table S3. RA-regulated genes expressed in depot specific manner

Supplementary Table S3A. RA responsive genes highly expressed in VS-ASCs

Column #	Gene	Gene name	Fold change	Location
28871	RBP1	Retinol binding protein 1,	8.27516	Cytoplasm
24419	MGP	Matrix Gla Protein	5.29882	Secreted
28754	RARRES1	Retinoic Acid Receptor Responder (Tazarotene Induced) 1	4.99255	Membrane; Single-pass type II membrane protein
1495	BAPX1	NK3 Homeobox 2	4.48321	Nucleus
28755	RARRES2	Retinoic Acid Receptor Responder (Tazarotene Induced) 2	3.61391	Secreted
26149	NR2F1	Nuclear Receptor Subfamily 2, Group F, Member 1	3.43103	Nucleus
28437	PTGS1	Prostaglandin-Endoperoxide Synthase 1	2.98568	Microsome membrane
3788	CDKN2B	Cyclin-Dependent Kinase Inhibitor 2B	2.89236	Cytoplasm. Note=Also found in the nucleus
27640	PLAT	Plasminogen Activator, Tissue	2.72317	Secreted, extracellular space
8763	HOXA5	Homeobox A5	2.49815	Nucleus
8762	HOXA4	Homeobox A4	2.4505	Nucleus
6175	F3	Coagulation Factor III	2.21223	Isoform 1: Membrane Isoform 2: Secreted
12124	HSD17B1	Hydroxysteroid (17-Beta) Dehydrogenase 1	2.06221	Cytoplasm
24219	MEIS1	Meis Homeobox 1	2.02231	Nucleus
3755	CDH6	Cadherin 6, Type 2, K-Cadherin	2.00627	Cell membrane

SUPPLEMENTARY DATA

Supplementary Table S3B. RA responsive genes enriched in SC-ASCs

Column #	Gene	Gene name	Fold change	Location
25085	MME	Membrane Metallo-Endopeptidase	5.94013	Cell membrane
27570	PITX2	Paired-Like Homeodomain 2	3.21041	Nucleus
32530	TNC	Tenascin C	2.71229	Secreted, extracellular space, extracellular matrix
5956	ENPP2	Ectonucleotide Pyrophosphatase/Phosphodiesterase 2	2.30375	Secreted
4719	CTSK	Cathepsin K	2.25696	Lysosome
4568	CRYAB	Crystallin, Alpha B	2.19852	Cytoplasm. Nucleus

SUPPLEMENTARY DATA

Supplementary Table S4. Primer sequence

Gene	Sequence
<i>CRBP1</i>	CCAGACAAAGAGATCGTCAG
	ACACACTGGAGCTTGTCTCCG
<i>WT1</i>	AGAGCCAGCCCGCTATT
	GGCGTCCTCAGCAGCAAA
<i>CEBPA</i>	AAGAACGTCGGTGACAAGAACAG
	TGCGCACCGCGATGT
<i>CEBPB</i>	GCAAGAGCCGCGACAAG
	GGCTCGGGCAGCTGCTT
<i>CEBDP</i>	CATGTACGACGACGAGAGC
	ATTGCTGTTGAAGAGGTCGG
<i>PPARG</i>	CGAAGACATTCCATTACAAGA
	GCTTTATCTCCACAGACACGA
<i>CYP26A1</i>	CATGTTCTCCAGAAAGTGC
	GGGATTCAAGTCGAAGGGTCT
<i>CYP26B1</i>	CACCACTCGTGTGAGC
	AGGTAACCTCCAGGGCCTC
<i>CYP26C1</i>	CTGCGTGGTCAAGGAGGT
	CGTGTCCCGGATGCTATAAC
<i>RARA</i>	GGTCGGCGATGGTGAGGGT
	TGGGCAAATACACTACGAACACAG
<i>RARB</i>	GATTTCCTACACTGCGAGTCCGTC
	GTGGAGATGGGGGGCTTG
<i>RARG</i>	CGCCGAAGCATCCAGAAGAAC
	GGTGACAGGGTCGTTGGCG
<i>RXRA</i>	GACGGAGCTTGTCCAAGAT
	AGTCAGGGTTAAAGAGGAGGAT
<i>RXRB</i>	CTTCAAACGCACCATCCGCAA
	CCCGCTGACGCTCTCCTG
<i>RXRG</i>	ATGCTGCGTATCTGCACAAG
	AGGCAAAGACAAGGTCTGTGA
<i>HOXA4</i>	ACCCGTTCCCTCCATATAATC
	GCAACCAGCACAGACTCTAAC
<i>HOXA5</i>	AACTCATTTGCGGTGCTAT
	TCCCTGAATTGCTCGCTCAC
<i>RDH10</i>	ACCTGACGGCTGAAAGAGTC

SUPPLEMENTARY DATA

	GAAAAGCCTTAGTGGTCCAGAAG
<i>RARRES1</i>	AAACCCCTGGAAATAGTCAGC
	GGAAAGCCAATCCCAGATGA
<i>RARRES2</i>	AGAACCCGAGTGCAAAGTCA
	AGAACTTGGGTCTCTATGGGG
<i>GAPDH</i>	CAAGGTCATCCATGACAACTTG
	GGCCATCCACAGTCTTCTGG
<i>NR2F1</i>	ATCGTGCCTGTTCACGTCAGAC
	TGGCTCCTCACGTACTCCTC
<i>DHRS3</i>	CTACTGCACATCCAAGCGTC
	GGGAAACCTGACTCTCATGCC
<i>CDKN2B</i>	TGATTAGCACTTGGGTGACG
	CCTCCTCCACTTGTCCCTCA
<i>PTGS1</i>	TGCGCTCCAACCTTATCCCC
	AGAGGGCAGAATACGAGTGTAA
<i>ALDHIA1</i>	CTGCTGGCGACAATGGAGT
	CGCAATGTTTGATGCAGCCT
<i>ALDHIA2</i>	AGTGTGTTCCAACGTCACTGAT
	AGTCTGAGTTATTGGCTTTCG
<i>ALDHIA2 (#2)</i>	GGGTGTGTTCTTCAATCAAGGT
	TGGTGGGTCAAAGGGACT
<i>ALDHIA3</i>	TGAATGGCACGAATCCAAGAG
	CACGTGGGCTTATCTCCT
<i>ENPP2</i>	ACTTTGCCGTTGGAGTCAAT
	GGAGTCTGATAGCACTGTAGGA
<i>PITX2</i>	GCCAAGGGCCTTACATCCG
	GGTGGGGAAAACATGCTCTG
<i>CTSK</i>	GCAGAAGAACCGGGTATTGA
	GAAGGAGGTCAGGCTTGCAT
<i>CRYAB</i>	AGGTGTTGGGAGATGTGATTGA
	GGATGAAGTAATGGTGAGAGGGT
<i>TNC</i>	TCCCAGTGTTCGGTGGATCT
	TTGATGCGATGTGTGAAGACA
<i>MGP</i>	TCCGAGAACGCTCTAACGCCT
	GCAAAGTCTGTAGTCATCACAGG
<i>PLAT</i>	AAACCCAGATCGAGACTCAAAGC
	GGTAGGCTGACCCATTCCC
<i>F3</i>	TGAAGCAGACGTACTTGGCAC

SUPPLEMENTARY DATA

	GGGGAGTTCTCATACAGAGGC
<i>MEIS1</i>	GATATAGCCGTGTCGCCAAA
	CGGTGGCAGAAATTGTCACAT
<i>CDH6</i>	CTGCGACGGATGCAGATGAT
	CCCTGTTTCTCGATCCATGTTG
<i>HSD17B1</i>	ACGTGAATGTAGTAGGGACTGT
	GCGCAATAAACGTCAATTGAAAGG
<i>BAPX1</i>	TCCAGAACCGTCGCTACAAGA
	CCGGGCAGGTATTGTCTCT
<i>MME</i>	GTCTTCCCAGCCGGCATTCT
	AGTTTCTGCCATTGTCATCGAAGC